IAVE

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

How industrial arts can contribute toward developing reading skills
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- ☐ Vocational-Technical Education and Tomorrow's Schools, Emerson (pg. 18)
- ☐ Are You Research Sophisticated?, Schaefer (pg. 21)
- ☐ Guides to Industrial Arts Design, Howe (pg. 30)
- ☐ How to Write a Practical Objective Test, Evans (pg. 28)

October, 1961

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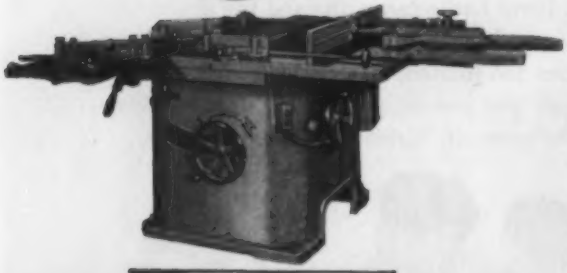

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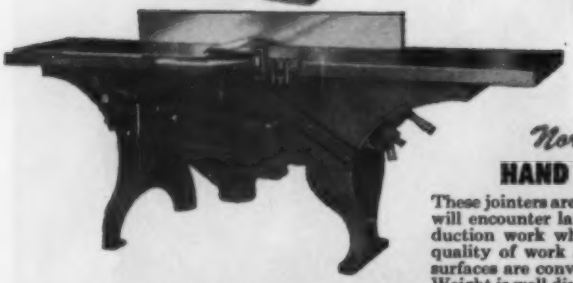

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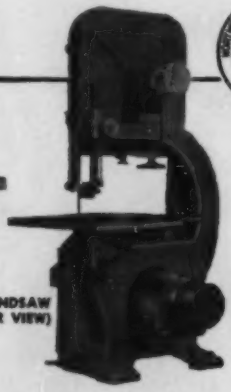

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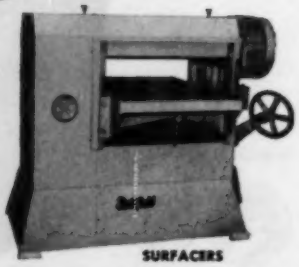

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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

October, 1961 Vol. 50, No. 8

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news

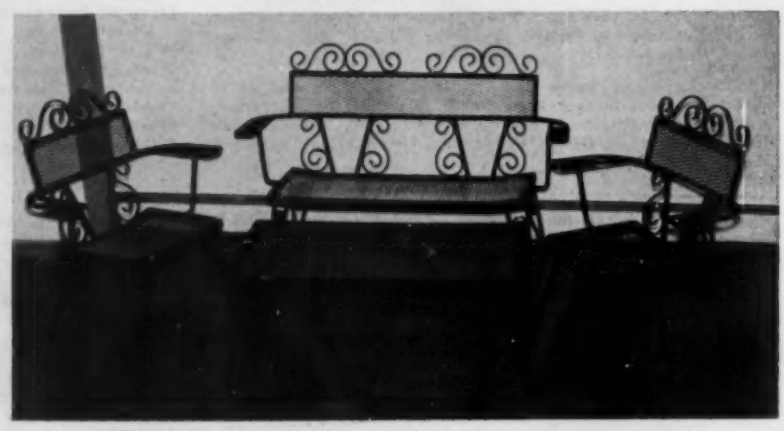
In the "Youth Employment Opportunities Act of 1961" bill introduced in the House Committee on Education and Labor by Carl D. Perkins (D., Ky.), provisions would be made for **federal support for on-the-job, supplementary vocational classroom instruction** for youths in co-operation with social and civic groups. Administered by the Department of Labor, the act would (1) develop methods for promoting the most effective utilization of the production potential of untrained and inexperienced youths; (2) provide useful work experience and training opportunities through on-the-job projects; (3) determine the effectiveness of these projects for the training and useful employment to meet current and future technological requirements of an expanding labor market; and (4) provide the nation with tested and proven training and work experience programs for school dropouts. □

The rapid progress being made in industry today demands that teachers of "technical subjects" keep in touch with new developments so that these may be introduced into the classroom as quickly as possible, according to Jack Kleinoder, past president of the National Tool and Die Manufacturers Association. The suggestion was made to the New York Machine Shop Teachers Association meeting. Mr. Kleinoder also told the teachers that they must begin "weeding out" the

(Continued on page 7)

AIAA awards winner

Twenty winners in four groups have been announced for the 1961 Industrial Arts Awards National Competition conducted by the American Industrial Arts Association. The view, above, shows the judging staff which includes, from left to right, William J. Micheels, president, Stout State College; Ralph Johnson, director, division of research and technology, National Association of Home Builders; Marshall Schmitt, industrial arts specialist, U. S. Office of Education; Homer C. Rose, chief, training development staff, FAA; John Hans Graham, American Institute of Architects; and William Parker, editor, Mechanix Illustrated. Below is a view of one of the first place award winners selected from the 145 finalists competing in the final judging. Harold V. Woods, Jr., Rockford, Mich., designed and constructed this set of wrought-iron furniture.



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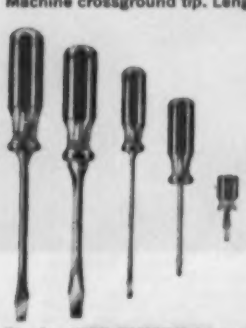

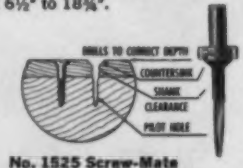

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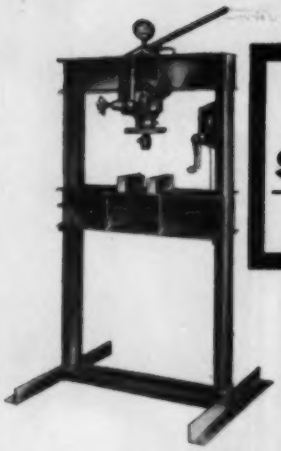

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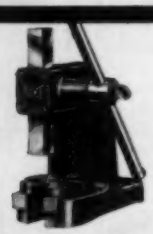

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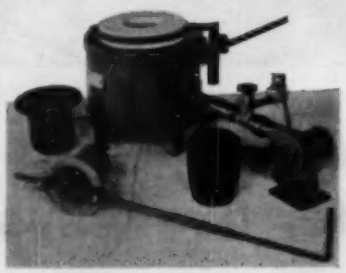

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NEWS

(Continued from page 4)

incompetents among their pupils. "Industry can no longer afford to work with men who lack sufficient ability to master what will be expected of them. The day of the grease monkey is over," he said. □

In commenting about the indications of a **decreasing vitality in industrial education** before the recent Michigan Industrial Education Society, Inc., Dr. Lawrence Borosage cited three symptoms as indicators of whether a profession is losing vitality: (1) when the majority in a profession cling to traditional behavior patterns even though confronted with new situations; (2) when there is a failure to define new professional goals that are both meaningful and challenging; and (3) when the way in which old wisdom is passed on to new people involves a tendency to adhere too rigidly to the ideas, approaches, and methods which have produced success in the past. □

In Philadelphia, **Goodwill Industries "Job Evaluation Program" for slow learning students has been declared as a great success.** Goodwill Industries and the **board of education** of Philadelphia in working together has developed a program for the school systems slow learning students. The "Job Evaluation Program" was geared with one ultimate purpose in mind, and that is to properly train, evaluate and properly place these students into jobs within the industrial market, using Goodwill's industrial setting for the training site. From October 3, 1960 to June 15, 1961 a total of 40 students (38 boys and 2 girls) entered the program from the E. S. Miller School in Philadelphia. These 40 students spent 119 days (19,040 hours) at the Goodwill facility. The age group of these students ranged from 15.5 to 17.5 years of age. On June 8, 1961, 29 of these students from this program graduated and had already been placed in jobs within the competitive market and were working either full or part time. Thus far the total gross earned income from this working group has been $17,750.52. □

New projects approved in the field of printing education by the International Graphic Arts Education Association include plans to: (1) utilize aptitude tests to select students for vocational and technical printing courses; (2) develop a national standardized series of achievement tests for vocational printing course seniors and the issuance of special achievement certificates; (3) publish new suggested outlines for courses of study covering the entire field of graphic arts education; (4) expand Printing Education Week programs in the schools; (5) publish a directory of the over 3000 graphic arts and printing teachers; and (6) publish a history of the graphic arts education movement in the U. S. These decisions were made during the 36th annual conference on printing education held at Ferris Institute, Big Rapids, Mich., during the last week in July. □

Technico, a nonprofit foundation, with offices in Providence, R. I., **has collected 100,000 lb. of surplus shop equipment for shipment to vocational schools in underdeveloped countries** in Latin America, Africa, and Asia. During the next year Technico hopes to supply 100 schools with some 1500 machines to help train an estimated 3500 technicians and skilled workers. It plans to go national with a plan under which companies will "adopt" and equip individual schools. □

The **second annual welding institute for secondary instructors will be held at the University of Wisconsin** at Madison and the Madison Vocational

(Concluded on page 55)

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technical education

Technical Institutes: What Do They Offer Youngsters?

ROBERT HAYS

Amid the headlines of "missile gap," "shortage of trained personnel," and "lack of technicians," one group of educators have been doing something effectively — if not dramatically — about the deficiencies in technical manpower. These educators staff America's two hundred-odd technical institutes and institutions with technical-institute types of programs.

The educators' efforts have proved a boon to industrial personnel and employment managers. As N. Brawnson Ayers, Field Manager, Customer Engineering, of IBM, says:

"The graduate of the technical institute has become a pillar of industry. He has reinforced technical knowledge with practical know-how. His understanding of physics and mathematics makes him a valuable assistant to either the scientist or the engineer. His orientation regarding industrial practices prepares him to understand the objectives of top management. His practical approach is appreciated by the production worker."

The first technical institute in the U. S. (Ohio Mechanics Institute) opened in 1828. In its century-plus of history the technical institute has emerged as the nation's most important source of technicians. Yet despite the number of technical institutes, their courses ranging from aeronautics to X-ray, and their significance to education, no schools have been less understood.

With all the publicity about "this technical age," technical institutes should burst with students. However, because of general misunderstanding about the technical institute, fewer than 80,000 young men and women are enrolled in engineering-technician programs. Fewer than half of these attend full time. In 1960 slightly more than 16,000 engineering technicians graduated.[1] The U. S. economy could probably absorb five times that many.

[1] *Technical Education News*, Nov., 1960.

Dr. Hays is a professor, Southern Technical Institute, Chamblee, Ga.

Many educators themselves do not understand what a TI is, perhaps because technical institutes embrace both engineering subject fields and applied laboratory practice. Some educators, therefore, view the technical institute as a half-baked engineering college, a refuge for those who cannot pass calculus. Others think it is a vocational school with courses in English glued onto the curriculum.

If many educators do not understand, the general public naturally has a blurred picture of the technical institute. One technical-institute staff member says, "Hardly a week goes by that we don't get calls asking about bricklaying or welding. But we don't offer a minute of bricklaying, and our only welding course is strictly a familiarization course."

Political leaders reflect the public's misunderstanding. Thus, the National Defense Education Act in 1958 provided federal support for engineering colleges, teacher training, and vocational schools. But most technical institutes received no federal support, even though the act stated its purpose as "the fullest development of the mental resources and technical skills of young men and women."

What Is the T-I?

What, then, is the technical institute? In brief, the technical institute trains technicians. The Engineers' Council for Professional Development (ECPD), national accrediting agency for technical colleges, defines the technical-institute curriculum as one "between professional engineering on one side and vocational education on the other." TI curricula, as the ECPD sees them, "prepare individuals for various technical positions . . . within the field of engineering" and are "essentially technological in nature, based upon principles of science." The ECPD specifically excludes training for artisanship from the purpose of a technical institute.

The ECPD currently accredits programs in 33 technical institutes. These institutions offer 121 accredited programs. The schools usually offer the Associate in Science or the Associate in Engineering. ECPD-accredited programs are primarily in the Northeast and the industrial belt from New York to Missouri. However, Miami, Fla., has one, and Sacramento another.

Some programs were formerly only one year long, but now all ECPD-accredited programs require at least two academic years of full-time work beyond secondary school. All require high school graduation or the equivalent. All base their curricular offerings upon mathematics and physical science.

The operational patterns differ. Twenty-seven ECPD-accredited programs are offered in evening school. Two are offered solely through a correspondence course, and many have co-operational work plans. Some TI's operate as state or local governmental agencies. Some have private endowment and some are proprietary institutions. Others operate under the extension division of a state engineering school. Several are sponsored by industry.

The Distinctions

But the question remains, just how does the technical institute differ from engineering colleges and vocational schools?

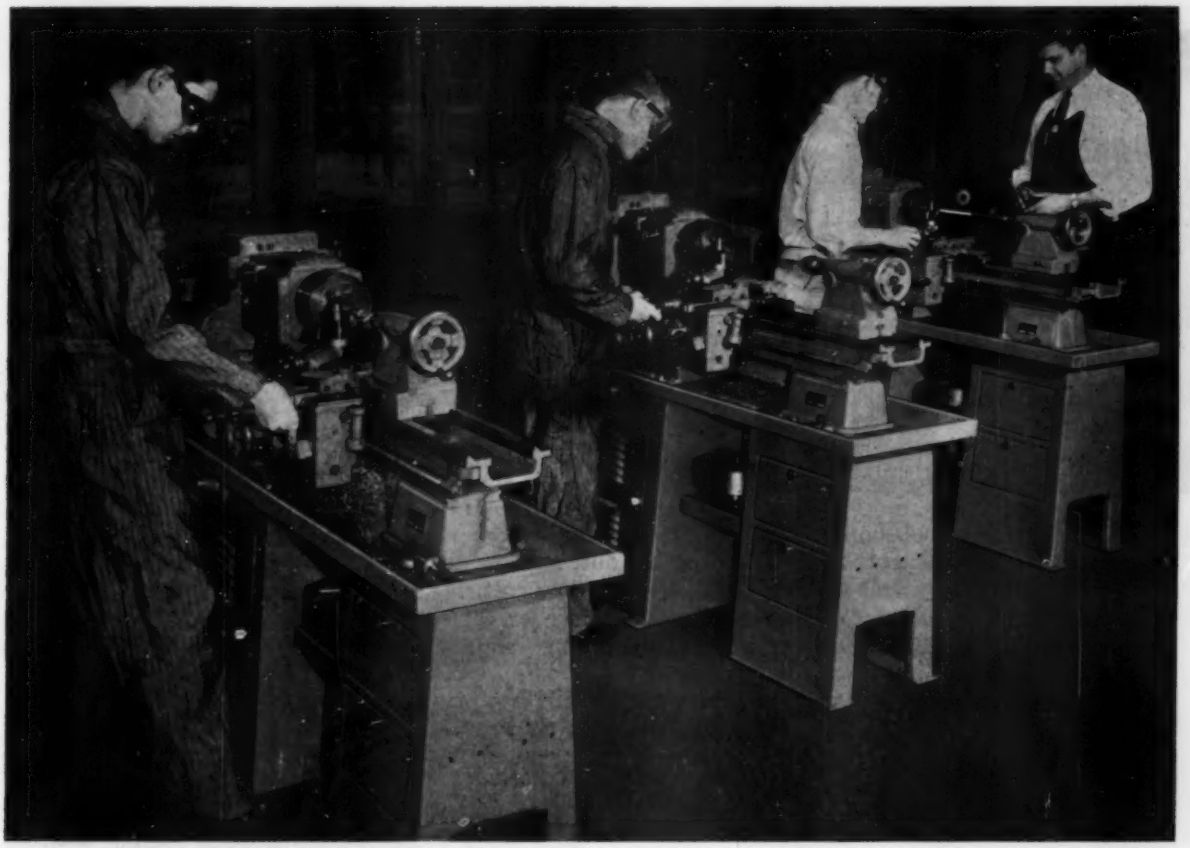
A concrete illustration would best show the difference. Construction technology is, naturally, a popular program; seven ECPD-accredited programs offer degrees or certificates in construction technology. In a metropolitan area, as for example, Atlanta, a student can pursue three types of construction training — engineering, technical institute, or vocational. The state engineering college, Georgia Tech, offers a degree in architecture. A unit of Georgia Tech's Engineering Extension Division, Southern Technical Institute, offers an associate in science degree in Building Construction Technology. The Smith-Hughes school in Atlanta offers trade-level courses in construction skills. The U. S. Department of Labor has a building trades apprenticeship program.

In the architectural (engineering) program the student pursues a five-year bachelor's degree in architecture; or a four-year bachelor of science degree in building construction; or a four-year bachelor of science degree in industrial design. After his bachelor's degree the student can earn two masters, one in architecture and the other in city planning.

In engineering college the student takes conventional college subjects: drawing, English composition, mathematics, and modern language his first year; more mathematics, humanities, and physical science his second year; architectural courses his last two or three years.

At Southern Tech, Georgia Tech's technical institute, the student takes mathematics through analytic geometry his first two quarters. He has four courses in English, including public speaking and technical writing. He has at least three courses in physical sci-

(Continued on page 10)



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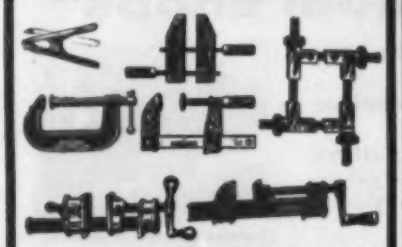

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TECHNICAL EDUCATION

(Continued from page 8)

ence. But — and herein lies a major difference between engineering-college and technical-institute curricula — he begins his specialty work early. In fact, he will have at least three courses in building construction during his first technical-institute year.

The emphasis will also differ. A technical-institute student will be less concerned with theoretical design, more concerned with applications of proved design methods. He will spend about 50 per cent of his total schooling time in laboratories and shops, applying his classroom theory.

In the same Atlanta area the student can pursue vocational training in bricklaying, wiring, carpentry, plumbing, and drawing. These programs of course vary in length and emphasis. Informal, on-the-job training and job-related training are additional avenues to skilled trade work.

The technical institute also differs from engineering colleges, liberal arts colleges, junior colleges, and vocational schools in the job targets for its graduates. Technical institutes offer primarily terminal programs leading to a "cluster" of job titles. Here again a concrete example helps. The glamorous field of electricity-electronics has been for some years the most popular technical-institute offering. Of the 121 ECPD-accredited programs — 40 or nearly a third — are in some branch of electricity, electronics, or radio. Central Technical Institute in Kansas City offers a program in electronics, another in radio and television, and a third in electronics by correspondence.

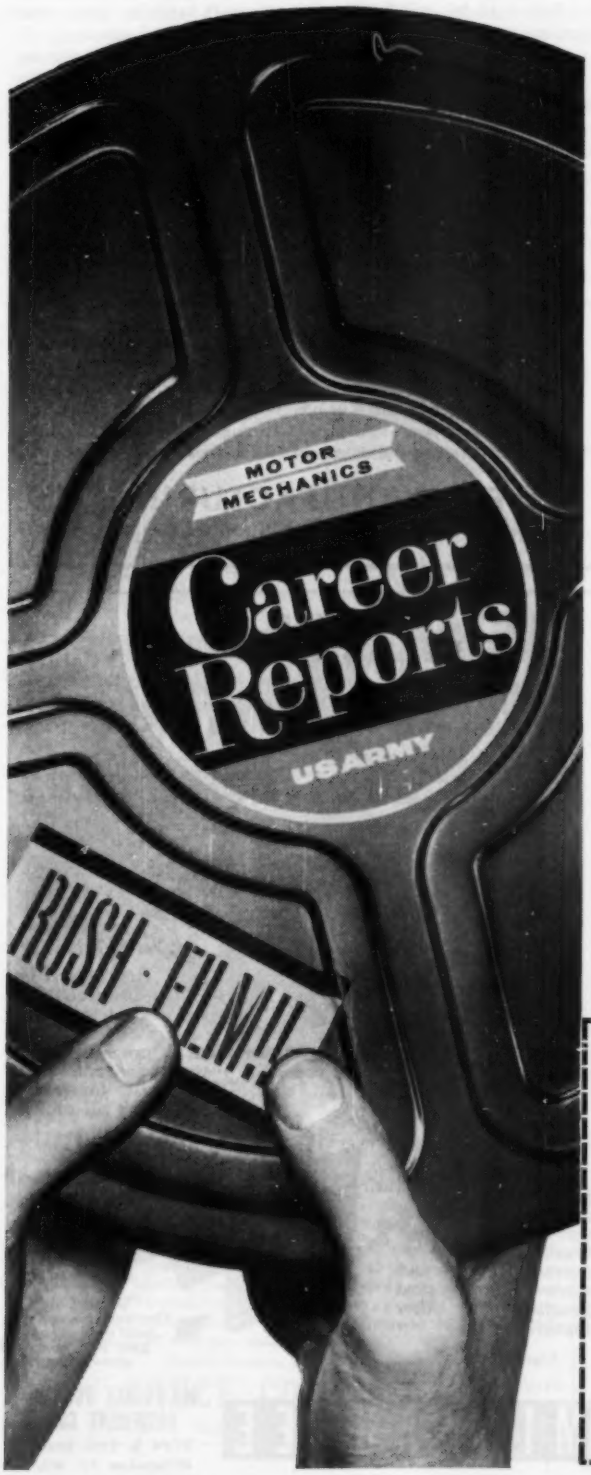
Graduates in electrical or electronics technology from a technical institute may become electrical technicians, electrical draftsmen, inspectors, technical sales representatives, research technicians, production supervisors, or maintenance supervisors. Job openings appear principally in the larger companies and in defense installations. Some graduates open their own testing shops or contracting companies soon after graduation. Although the technical institute is principally a terminal program, a few graduates do go on to earn baccalaureate degrees.

Other T-E Sources

Technical institutes are, of course, not the only source of engineering technicians. Two other sources are on-the-job experience and company training programs. These sources, however, do not usually supply well-rounded technicians. Two years of full-time technical-institute education will cost too much for most industrial concerns. For example, Oregon Technical Institute, Klamath Falls, Ore., a state-operated institution, charges residents of Oregon only $95 per term in fees ($285 per year) and nonresidents an additional $90 per year. But to duplicate Oregon's

(Continued on page 14)

To help you guide the seniors who don't go on to college



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Who sponsors this project? Career Reports is sponsored by the Department of the Army, with cooperation from the American Personnel and Guidance Association, and other recognized vocational authorities.

What is the Army's purpose? Each film in the series conveys a distinct axiom: training is indispensable to success in any skilled occupation. Beginners can acquire this training in one of several ways—on the job (by means of formal or informal apprenticeship), through a trade school or company training program, or in the Armed Services. The Army's purpose is achieved simply by being recognized as one of the possible ways in which a young man can secure essential vocational training.

An early reservation is advisable. For the first time, a comprehensive guidance tool has been prepared specifically for high school graduates not able to go on to college. The Career Reports series is available (without charge) to teachers and guidance counselors in the United States. Reservations must be made early in order to incorporate Career Reports into your guidance program for the coming academic year. May we therefore suggest that you mail the coupon today for free details.

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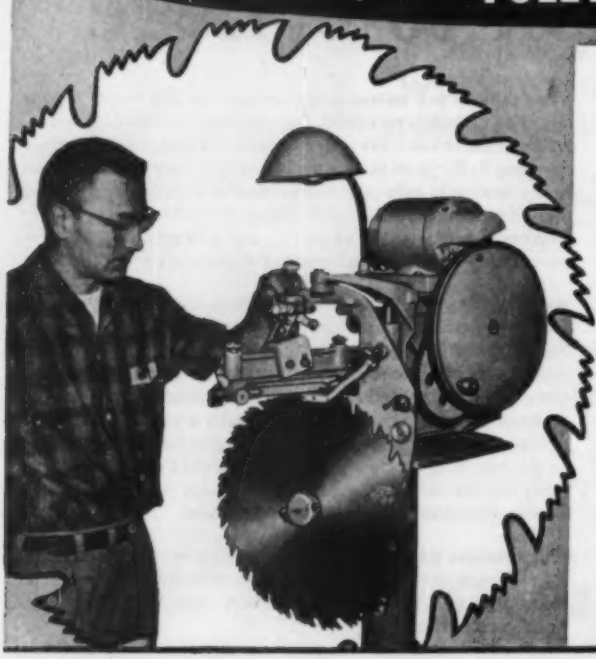

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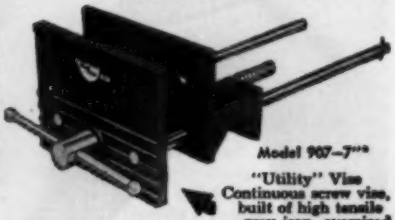

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TECHNICAL EDUCATION

(Continued from page 10)

ECPD-accredited programs, an industrial company would bear not only the cost of the teaching and investment in plant but also the employee's salary during his training program.

A company-sponsored program will thus usually offer training restricted to immediate application in the company's production. Mathematics and other basic subjects will suffer, and even the technical subjects will shrink. A few industrial firms, however, have sponsored genuine technical institutes. For example, Radio Corporation of America sponsors an ECPD-accredited program in electronics through RCA Institutes in New York City.

Most U. S. technical institutes do not yet have ECPD-accredited programs. Some non-accredited programs are no doubt educationally sound, but for administrative reasons have not yet been subjected to accreditation inspection. But some organizations call themselves "technical institutes" with no more right to the title than a listing in the classified telephone directory. They give the students little. Under many state laws a proprietary school needs only a business license and a month's rent; consequently, a few fly-by-night schools have endangered the good name of many others.

An Increasing Need

An increasing need for trained technicians assures the future of a respectable technical institute. In 1957 the Carnegie Corporation sponsored a national survey of technical institutes. The survey teams (on which the present author served) found that among 90 companies in the U. S., the present ratio of technicians to engineers was about 0.8 to 1. Employers stated that, by 1967, the ratio should be 2.2 technicians to each engineer, representing an increase in the ratio of technicians to engineers by nearly 200 per cent.[2]

Some technical-institute educators consider even the 1967 projections too low. For instance, L. V. Johnson, for many years a member of the National Committee of the Technical Institute Division, American Society for Engineering Education, says:

"An average ratio should be at least five technicians for each engineer. Of course, individual companies differ in their manpower demands. But many industrial companies are not using their engineers properly. Much of the shortage of engineers is really a shortage of technicians. When you see a company using an engineer as a heavy-up draftsman or a production supervisor, that company is not using its engineering talent well. Trained technicians could do as much as three fourths of the work now being assigned to engineers, could often do the work better, and could release engineering talent for its proper utilization."

In the future, though, more companies will surely place technicians correctly on their organization charts. Many have already discovered the best ways to use technicians. C. N. Hoskins, personnel manager for American Art Metals, has employed more than a dozen technicians in the past five years. Hoskins says:

"We find that the technical institute graduate performs equally well on staff and line functions. Technicians are not employed to replace engineers: rather, in our industry we recognize very few tasks that call for the graduate engineer. Most of our openings match the technician's educational and experience level perfectly; the placement of an engineer on these jobs would be a waste of talent and ability to the employee and employer."

Hoskins states he is generally pleased with the technicians he has hired, and that, "Our corporate plans for growth include many more openings on the technician's level, and we look to our own local technical institute to meet this demand."

The future should also see more technical institutes opening and more earning accreditation. In the six years prior to 1960, the number of technical institutes with accredited programs rose from 27 to 33. The number of accredited programs rose from 84 to the

[2] Henninger, G. Ross, *The Technical Institute in America*, McGraw-Hill, 1959.

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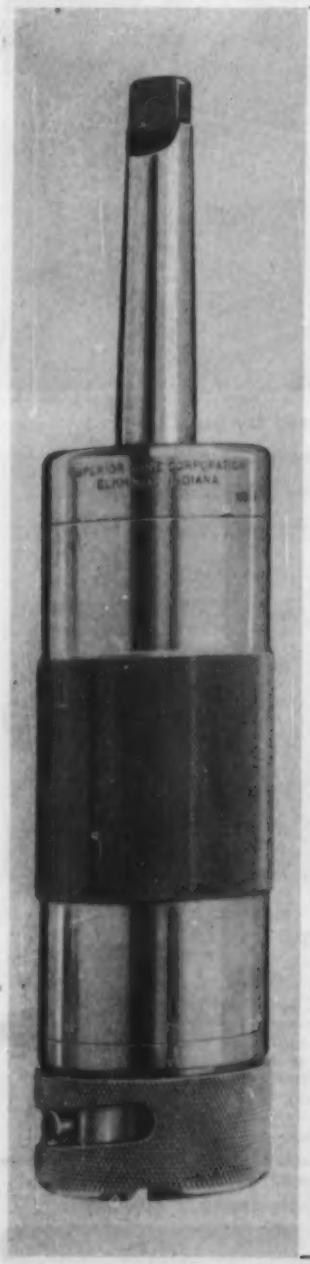

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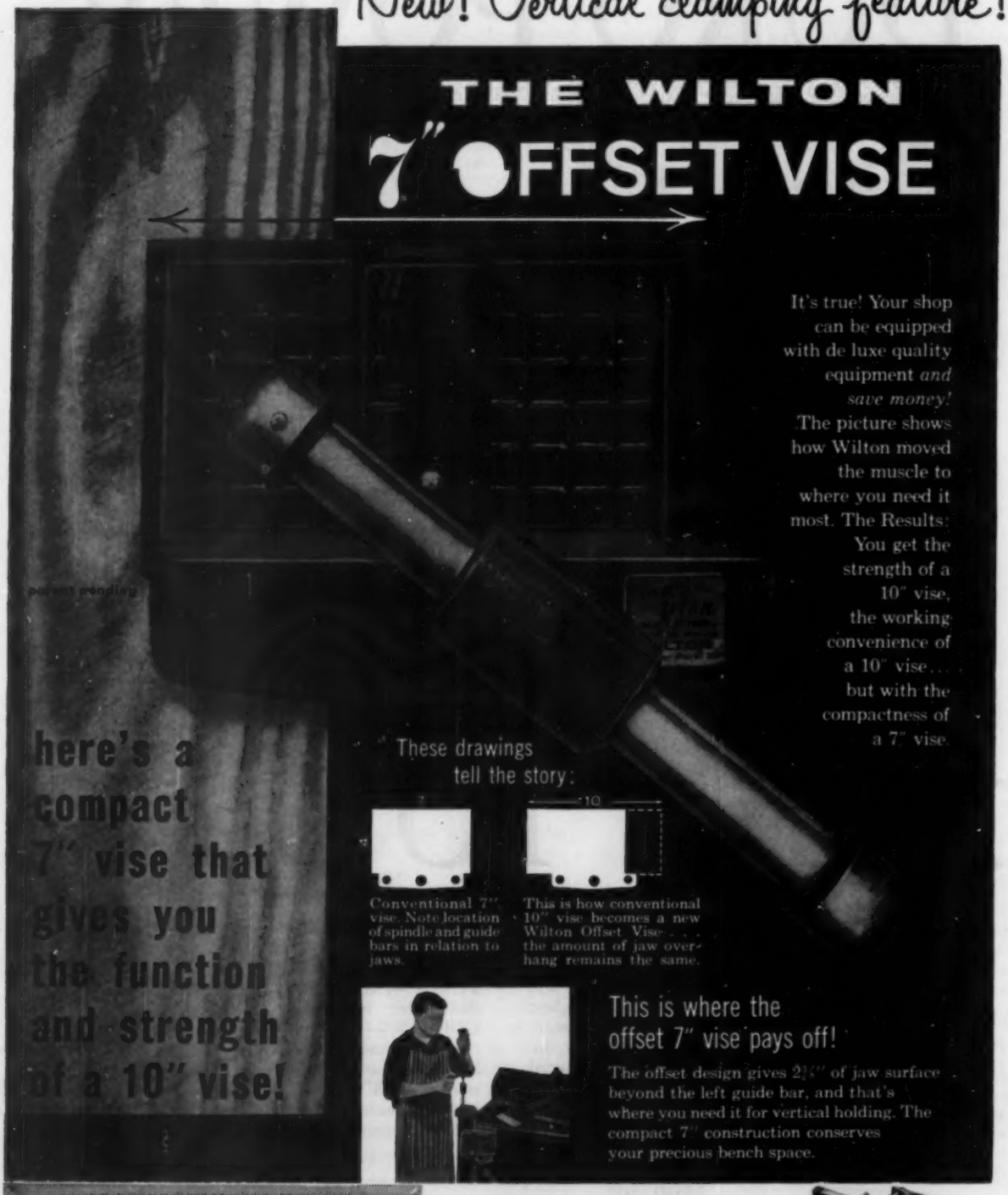

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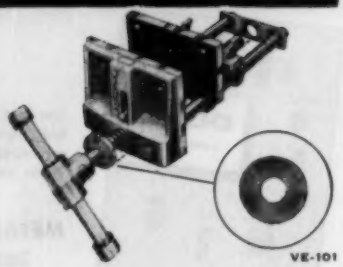

VE-101

the editor's stand

WHAT SHOULD INDUSTRIAL ARTS BE LIKE TEN YEARS FROM NOW?

Every company, professional organization, and governmental agency looks forward to the future and makes extensive plans for it. Industrial arts should also be planning its future. We should determine now the kind of industrial arts program that we hope to see in all American schools ten years from today. What should industrial arts be like a decade from now?

Our Country in Ten Years

Since industrial arts, to some extent at least, should reflect the economic and industrial development of America, we must first look at what the United States will be like ten years from today. These are a few of the changes that we know will take place: there will be 40 million more people in the United States; we will have jet airplanes operating at twice the speed of the present jets; there will be new refinements in atomic ships, fantastic electronic brains, and all the present wonders of our industrial society will be improved and enhanced; we will be using many new products that have not yet been discovered in the research laboratories. In the case of some growth companies, well over 40 per cent of their products will be new. In fact, many of these products are now being developed in the research laboratories today.

Because of greater and greater application of automation, there will be less and less need for semi-skilled workers in manufacturing even though the amount we manufacture will be greatly increased. There will be a much greater need for workers who provide *services* — maintenance and repair of manufactured items. Everyone will have a larger income, particularly those in the middle-class group. We will have a shorter work week, perhaps not over 30 hours per week and this will provide a great deal more time for recreation and other pursuits of a personal nature. Developments in the science of electronics will be proceeding at a tremendous rate. Most of the electronic equipment we are now using will be completely obsolete. People will be more mobile than ever; they will tend to live in many different places. Most people will make their permanent homes in a community different from the one in which they attended high school. There will be a greater demand for the technician and skilled tradesman.

If this is the world in which we are to live, what then should our industrial arts program be like? Before we make any predictions, perhaps we should review the present status of our program. While some may object to this description, it is nevertheless the average program in our American schools. Certainly there are many that are far better, but there are also many that do not even match these meager standards.

Industrial Arts Today

Our program is largely woodworking with a little drawing. This is true because most programs that call themselves "general shop activities" are in reality glorified woodworking. Project-making is still the basic goal of both teacher and student. Both appear to be working toward this as the end result of industrial arts. Students are learning some facts and some skills in the use of tools and machines. There is very little problem-solving and, in many cases, a minimum amount of project planning. Unfortunately, the average industrial arts course is planned primarily for the slow learner; there is little challenge for the above-average student. There is almost no applied mathematics or science in the average course and many teachers do not stress the language arts as they apply to industry and technology. Most of our projects represent little attention to good design.

Industrial Arts in a Decade

What should our goal be for the "good" industrial arts program ten years from now? These are some suggestions that we think should be given some careful consideration:

1. The curriculum should be geared to the technology of the era. If we are to continue with our present curriculum pattern, each of the areas should be greatly enriched. For example, a traditional area such as woods should be completely revamped to include a study of modern man-made materials, the latest methods of machining woods, and a study of the best building techniques in home building and in the furniture industry.
2. There should be several kinds of industrial arts to appeal to students of all abilities. In some cases, a program emphasis of experimentation, research, and problem-solving should be designed for the above-average student. In these courses, experiments and exercises in problem-solving should be the common educational activities.
3. Design in its broadest sense should be emphasized. Students should be exposed to good design in the shop, not only in the kinds of projects they design and make, but also in the way in which the shop itself is equipped and in the kind of instructional materials available to the students.
4. There should be greater emphasis on the use of oral and written language and especially on the need for an understanding of technical vocabulary as it applies to each area of work. One illustration of this emphasis should be the use by every industrial arts student of a basic textbook.
5. Applied science and mathematics should be emphasized in every situation in which a natural and practical application can be made. *Industrial arts, however, must not attempt to ride on the coattails of the mathematics and science courses.*

If we are to follow these suggestions, how should our courses be organized? The best possibility is to enrich the present curriculum and to add areas that are lacking at present. Under this program, at least the following six areas should be included: (1) drawing, planning, and design; (2) general woods; (3) general metals; (4) electricity-electronics; (5) power mechanics and transportation; and (6) graphic arts.

There are some who believe that we should scrap this organizational pattern and replace it with some new pattern such as a curriculum organized around technological areas of manufacturing, construction, research, and so forth. It is our conviction that any drastic reorganization in industrial arts is neither practical nor realistic. We believe that much more can be accomplished by enriching our present curriculum and that we should strive for this goal in order to make real improvement in industrial arts in the next decade. □

John L. Feirer

Vocational-Technical Education: Its Place in Tomorrow's Schools

LYNN A. EMERSON

□□□ *All about the implications our changing technology has for the type and level of instruction in the areas of vocational and technical education in the schools of tomorrow.*

During the past half century the secondary schools of the United States, especially those in the larger cities, have given considerable attention to industrial education. Rapid changes in technology in recent years have created new needs — needs for changes in present programs and for the development of new programs in keeping with the new technology. The purpose of this article is to outline briefly the essential elements of vocational-technical education, present trends in programs, and some directions in which secondary school programs might move.

Vocational-technical education is specific preparation for occupational life. The content of its programs is derived from analysis of the duties and responsibilities of workers in the specific occupational field toward which the program is aimed. The analysis is developed in close contact with persons actively engaged in the occupation. It includes the skills and abilities needed, the knowledge and understanding required, and the attitudes which are desirable. Vocational-technical education takes the form of pre-employment programs designed to prepare workers for effective entrance into industry, and also the form of extension education for employed workers to update them with respect to new developments or to upgrade them to advanced positions.

In the field of industry, vocational-technical education in the public schools is mainly concerned with educating skilled craftsmen, and of technicians. The training of semiskilled workers is usually done directly by the employer.

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1. Vocational Aspects

The work of the skilled craftsman is largely the use of highly developed manual skills carried out with sufficient understanding of the technical aspects of the job to enable him to perform his tasks effectively. The technical knowledge needed is derived from the analysis of the work tasks, and it is usually closely related to the manipulative skills. Some of the skilled crafts demand much more in the way of technical understanding than do others.

Pre-employment education, for the skilled crafts involves large amounts of practical work in well-equipped, specialized shops. Usually the curriculum provides for one half or more of the total school time to be given over to shop work. The instruction in the related technical subjects is usually provided in classrooms, although laboratory work is sometimes used. The curriculum is aimed at a specific skilled craft, such as machinist, electrician, or bricklayer.

2. Technical Aspects

The work of the technician deals largely with technical knowledge and understanding. He needs highly developed technical skills, the ability to apply technical knowledge to the situation at hand. He needs some manipulative skills, but these are usually a minor element as compared with the technical skills. Technician occupations vary greatly in the breadth and depth of their technical content. Some technician occupations border on the skilled crafts; others are similar to jobs in the field of engineering. Some typical technician occupations are draftsman, electronic technician, tool designer, highway engineering aide, etc.

The curriculum for the pre-employment training of technicians is designed to prepare the student for entrance into any one of a cluster of closely related occupations. Thus, it is broader in scope than is that for skilled craft training. Its main objective is the development of technical skills needed for the occupational field toward which it is aimed. The curriculum usually includes much basic and applied mathematics and science. Laboratory work, designed to develop technical knowledge and technical skills, has a major place in the curriculum. The intellectual level of student required for successful completion of the technician curriculum is somewhat higher than that needed for the skilled crafts.

Vocational-technical education programs for pre-employment training of skilled craftsmen and of technicians are found at present on the high school level and on the junior college level. Many programs are found in area vocational schools, which may be of high school level or of junior college level. Some area schools offer programs on both of these levels. As indicated later in this article, the trend is toward the post-high school level, especially with respect to the training of technicians.

Changing Technology and Schools

More changes in technology have occurred in the past ten years than took place in many previous decades. Crystals with strange properties, transistors, jet aircraft, tape-con-

trolled machine tools, computers, nuclear reactors, automated factories, missiles, man-made satellites — these are some of the more important developments. They have had great impact on the work jobs of industry. Instrument watchers are replacing semi-skilled machine operators, skilled craftsmen need greater technical competence, and a host of new jobs is emerging in the technician field. Along with these changes have come greatly increased demands for competent engineers and scientists.

The changes within industry have had their impact on vocational-technical education programs, especially in the more progressive schools. Curriculum changes have been made, more attention has been given to appropriate selection of students, new programs have been developed.

Foremost among these developments is the establishment of many new programs for the training of technicians, stimulated by the federal funds available under Title VIII of the National Defense Education Act of 1958. Occupational surveys of technician occupations have been made in many communities. A large expansion of programs is under way in such fields as electronics, mechanical technology, electrical technology, instrumentation, and others. The typical program takes the form of a two-year curriculum on the post-high school level.

The rapid expansion of training programs for technicians during the past two years is perhaps the most spectacular change in industrial education. Yet other changes have been taking place which have important bearing on program development for tomorrow. Among these are the rising age and grade level at which vocational-technical education is offered, the increasing size of the educational administrative unit for operating vocational-technical programs, and the increasing numbers of young women enrolling in programs which prepare for industrial occupations.

The gradual rise in age and grade levels for vocational-technical education programs has far-reaching implications. This rise has been brought about by industry's demand for more maturity in the new workers hired, by the increasing technology needed by the worker, by social pressure to keep youth in school longer, and by other causes. Machines and tools used in industry today are expensive; the cost of mistakes made by immature workers is often high. Many of today's jobs, especially in the technician fields, require much greater breadth and depth of training than was formerly needed. The impact of these pressures from without the schools has resulted in the gradual shift of technical education programs for industry from the high school to the post-high school level. Vocational education programs are still operated in the high schools, but the unmistakable trend is toward the post-high school years for technical programs. In states which have well-developed junior college programs the tendency is to place the technical education in such institutions. In some other states the movement has involved the development of area vocational schools, serving relatively large geographical areas, with entrance requirements which include high school graduation or adult maturity. This change may well have profound bearing on what the content of the high school curriculum of tomorrow should be to meet the needs of youth who will enroll in such post-high school vocational programs.

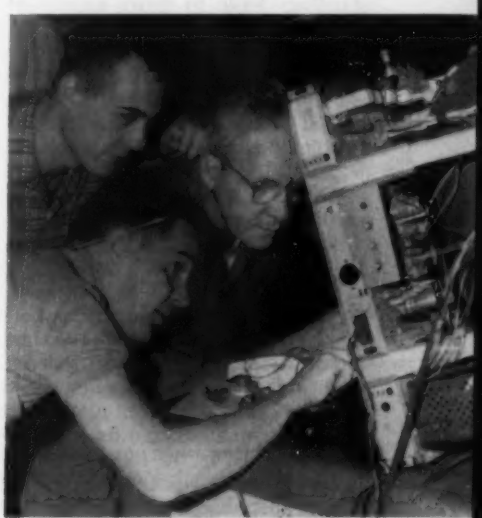
The increasing size of the administrative unit for technical education follows logically the rise in age-grade level of the programs. Students come to these institutions from many different high schools, for the program must be of reasonable size for efficient operation. The tax base for the support of the program must reach back into several high school districts, and such programs are financed by the establishing of special districts, by the county unit, directly by the state, or by some other pattern which spreads the costs over a suitable geographical area. Often the state provides subsidy in one form or another, for the cost of operation is considerably higher than for a high school program. The elaborate and expensive equipment needed for modern vocational education programs, especially those which prepare for the technician field, is often beyond the financial resources of the local community.

Slow but important increases are noted with respect to the enrollment of young women in programs which prepare for industrial occupations. Reports of the Department of Labor indicate that, if the total personnel needs of industry are to be met in the decade ahead, much larger numbers of women must be employed. Technological changes are removing many of the heavy physical demands upon workers, and today women can perform satisfactorily in many of the highly skilled positions especially those of technician type. It is probable that we shall see considerable increase in the enrollment of women in training programs which prepare for such occupations. We may also see greater utilization of women as teachers in technical programs.

Needs for the Coming Decade

As one looks ahead at the needs in vocational-technical education for the coming decades, it is apparent that many changes will be needed in present programs, and that many new types of curriculums will be required. Increased attention will need to be given to strengthening the science and mathematics of the several programs. Improved instructional materials will be needed, with possibly considerable utilization of "machine teaching." Relatively more attention will be needed to program development for the maintenance and service occupations, including the servicing of automated equipment. Retraining of persons displaced by automation or other causes, and the retraining of retired persons, will need attention. Many of the programs will need increased toughness beyond present standards, and better selection of students. Since the programs are influenced considerably by the regulations established for the utilization of Federal funds for vocational-technical education, new leg-

If the school system is to meet all the needs for industrial education, it must face the task of offering appropriate curriculums for basic pre-vocational education, as well as specialized vocational-technical education. . . ."



— Arkansas Vocational-Technical School

— Southern Technical Institute

islation is needed which will do away with obsolete provisions in present laws and provide increased Federal support for types of programs needed for present-day industry.

New Exploratory Approaches

One of the most important needs in program planning for tomorrow is an appropriate type of high school education for those youth who will not go on to college but who will find employment in industry either directly after completion of high school or after one or two years of post-high school specialized vocational education.

Much of our learning comes through books, but a great deal of it comes through other media. Many high school youth need the opportunity of learning by actual contact with materials and equipment, by working with resistant materials, and by using tools and instruments. Such activity tends to provide meaning for the drawing, mathematics, and science. Through such activity the student acquires skills and understandings basic to many aspects of occupational life. Industrial arts provides some opportunity toward these ends. But industrial arts in its present form is not enough. What is needed is a new approach to curriculum building to meet these objectives, and the establishment of new types of programs. These should supplement, rather than replace, industrial arts. Although the work activities of the proposed program may appear similar to industrial arts, their objectives are different, the time allotments are higher, and they are aimed at specific groups of students. The content of such programs would be basic content found in large numbers of occupations, and its organization would be in the form of prevocational work which leads to the highly specialized vocational education which will be offered largely on the posthigh school level or through apprenticeship.

The task of outlining a prevocational program for the skilled crafts is not an easy one, for these crafts are many and varied. Since the program is a basic one, providing foundation training for several crafts, some grouping of the crafts will be needed. For example, there are many skilled crafts dealing with metals and metal products, such as machine shop work, mechanical maintenance, automotive maintenance, air conditioning and refrigeration, sheet metal work, plumbing and steam fitting, and welding. Other crafts require some skills and understanding concerning metal products although the main portion of the work of these crafts is in other areas. A basic program might well be designed for the metalworking field, basic to the many skilled crafts found within this field. The content for such a program would be derived from a careful analysis of the many metal products crafts, with a listing of the manual and mental skills, and the knowledge and understanding common to most of these crafts.

The program content might well include the selection and use of hand tools; the principles of operation of machine tools, and the development of simple skills in their use; materials and processes of industry, with special reference to the skilled crafts; basic principles of applied science, taught on a level appropriate to the type of student enrolled; interpretation of drawings; basic mathematics, with application to skilled crafts work in the metal products field.

The curriculum pattern for such a program would grow out of the content of this analysis, with time apportioned to relative needs and with due consideration of appropriate methods of teaching. It might well be weighted in favor of laboratory work designed to provide familiarity with tools, materials, and processes, together with the development of some manual skills. Some of the laboratory work, however, would be designed to develop in the student the understanding of basic science and of technological processes. Much use might well be made of appropriate audio-visual materials in the classwork. The overall time allotment for the prevocational work of the curriculum might be as much as half of the total time with the remainder devoted to English, social studies, general science, mathematics, etc.

It should be kept in mind that the program outlined here is designed for students with interest and aptitudes appropriate to the skilled crafts. Studies of students enrolled in present-day high school vocational-technical programs generally show mental alertness scores lower than those who enter college. The program difficulty should be geared to their abilities and should challenge their best efforts.

The suggestions outlined above may be somewhat radical and at variance with present practices. But as one looks at the steady rise of vocational-technical education with respect to age and grade level — to the end that in the near future little of it will remain in the high school — one must begin to think critically of the kinds of programs needed to keep the youth in school who are now enrolled in industrial education programs or who drop out of school because the academic program does not meet their needs and interests.

High School and Industrial Education

The secondary schools of the United States should serve all youth. At present they are primarily geared to meet the needs of those who are going on to college. This is a most important objective, for the needs of present day society demand increasing numbers of persons with broad as well as specialized higher education. Yet it must be kept in mind that hundreds of thousands of students now in high school do not have the abilities and aptitudes needed for successful pursuit of college work. Society needs the services of these youth, appropriately trained for occupations which fit their abilities and interests. Industry has need for many scientists and engineers; but it needs technicians, skilled craftsmen, and semiskilled workers in far greater numbers. If the schools are to meet these varied needs, they must give increased attention to providing the kinds of education required by all the youth. □

Are You Research Sophisticated?

Industrial Educators Need To Be

CARL J. SCHAEFER

□□□ What types of basic research are there and what do they mean to the industrial educator and his efforts?

Educational researchers communicate in a jargon somewhat unfamiliar to the average industrial education teacher. For example, a "hunch" is a hypothesis, a "design" is a procedure, and a "variable" may be a number of different things many of which can't even be accounted for. "Reinforcement" is not something put in concrete to make it stronger; and "control group" is not how well the teacher disciplines a group of students. These and many other terms are going to be found more frequently throughout the professional literature, because educators are becoming research minded.

To imply that industrial educators are not problem solving minded would certainly be incorrect. However, to say they are research sophisticated would also be a mistake. Enough formal research just isn't in evidence in industrial education. From the conception of the Cooperative Research Program (Public Law 531) industrial education has had less than a half dozen studies approved for grants. Only a handful of formal research staff studies have been going on over the years. Few industrial teacher education institutions even consider releasing staff members part-time to do research as is often done in other disciplines. The bulk of industrial education research has been at the graduate student level; and even here the number of studies leaves something to be desired. A recent count shows 25 graduate industrial education studies appearing in the 1960 *Dissertations Abstract*.[1]

Research Is Formal

Research constitutes a sophisticated undertaking. It involves well-laid plans, rigid controls, methodical execution, and final analysis to a degree often well beyond the problem solving techniques used by the average industrial educator. It is specific, well calculated, and methodically performed if tangible results are to be obtained.

Industrial educators have been using informal problem solving methods for many years and practitioners, especially at the local level of operation, are experts at finding workable solutions to meet immediate situations. The wisdom of using advisory committees was recognized early in the history of industrial education, although there appears some evidence that their use is waning. Surprising enough, general education is only now realizing the value of such close-at-hand resource persons. Consultation with certain individuals who may have something beneficial to contribute to the particular solution being sought has been a common practice of industrial educators. Conferences, workshops, and state and national meetings have become common tools in providing a basis for informal problem solving.

Solutions to local, state, and even national problems have been found through the use of such informal methods and industrial education has continued to profit from their use. Yet the greatest danger in using such techniques to solve problems is to interpret the findings by these methods to be all conclusive and final, thus neglect or totally disregard the important steps of further study. Too often, in industrial education the informal method has merely supplied the hypotheses or "hunches" which are mistakenly declared conclusive without adequate testing. This frequently happens on the local level of operation where once something is made to work — or a problem is temporarily solved — the local proponent makes inference at state and national meetings that his solution should be generally accepted.

Research then is something more than merely meeting every day problems and coming up with some workable solution. Research "digs deeper" and "goes farther" than informal problem solving. It is more diligent and systematic inquiry or investigation into a problem and it discovers facts or principles from which conclusions may be drawn. In other words, research is problem solving of the highest order.

Teachers Are Consumers

To say that teachers are consumers of research implies that they are at least intelligent consumers. Most individuals would not think of just buying any make automobile. Before making such a purchase a great deal of time usually is spent in evaluating and comparing all of the various mechanical and style features of respective makes and models. After due deliberation a choice is made and everyone likes to at least feel that the best choice was made. This is the way it should be with research. Teachers should be intelligent consumers of research findings.

But even before research can be consumed or utilized, there must be a willingness on the part of those concerned to recognize the need for change and an acceptance of change if the evidence seems to indicate a possible improvement. Its like getting into the frame of mind to purchase a new car. In other words, research results can not be accepted with a *status quo* attitude. Once problems are recognized by the teacher and he or she is really looking for a solution or a better way of doing something, then we have a good candidate for a consumer of research. But the fact remains, a consumer of research must be research sophisticated to understand and be able to judge good research findings from poor ones.

Types of Research

Educational research usually is classified into three distinct types: experimental, descriptive, and historical. Each has its own distinguishing characteristics.

1. Experimental Research. Experimental research is the systematic analysis of what will be, or what will occur, under carefully controlled and accurately measured conditions. The intelligent consumer of experimental research will want to be acquainted with experimental designs and controls that go to make up

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[1] *Dissertation Abstract*, 1961. University Microfilms, Inc., Ann Arbor, Mich.

a good study. Probably the most simple design is represented by the pre-test, post-test pattern with a single individual or group. The tests (pre and post) may be identical or they may be equivalent forms of the same test. In other words, a test covering the same material but the questions changed. In this simple experimental design, the study is carried on by pre-testing the group (or individual) to find out the starting level. For a group this will usually be the average of the grades or scores.

Next new information, say unit 1, is taught to the group using the usual method or device of presenting the unit. This would be the normal or customary way. The researcher calls this the control method or factor. A final or post-test is given and the pupil average is determined. Pupil mean gain is determined by subtracting the pre-test scores (average) from the final or post-test scores. The same students are then taught a different unit of work and again started out with a pre-test. This time, instead of teaching in the usual way, an experimental method or device is used. Such an addition or change from the normal is called a "variable." The addition of a single variable makes possible accurate measurement of change. Again the pre-test, post-test would be administered and the pupil mean gain determined.

The result of the pupil mean gain for the control method is compared with the pupil mean gain for the experimental method. An evaluation then can be made as to which method, control or experimental, produced the greatest pupil mean gain. Repeated findings of this nature may indicate rather positively in favor of one method or the other. If, however, the experiment was only conducted a time or two, the results may not be really conclusive and the intelligent consumer of experimental research would hesitate to accept the findings. There are other experimental designs which manipulate and rotate groups and individuals in various ways, but most are based on the pre-test, post-test and variable idea.

Experimental research usually involves the use of statistics. These mathematical calculations determine the probability of the recurrence of the findings under similar conditions. In other words, most experimental research statistics will infer or provide generalizations from numerical information gathered from a small group, and apply it to larger groups from which the information has not been drawn. It is customary to call the small group the "sample" and the large group the "population."

2. Descriptive Research. Descriptive research methodology plays an appropriate role in determining the *status quo* of certain phases of education. Most teachers are acquainted with the descriptive research of James B. Conant entitled, *The American High School Today*.[2] This is an outstanding example of a descriptive type study which has focused attention on the present or status of the situation.

Descriptive research serves the function of describing and interpreting *what is*. It is concerned with points of view, prevailing practices, attitudes, existing situations, and opinions and trends that are developing. Descriptive research relies on the survey method of gathering data from a relatively large sample or number of cases. It is intent on finding descriptive statistics which when analyzed will provide characteristics at a particular time. Descriptive statistics provide numerical data for a single group and only this group. No inference can be made beyond the group itself and such data merely describe or depict the measurements or characteristics as found within it.

Much local level problem solving is based on descriptive statistics. Such data are collected by the survey method (school survey, social survey, market survey, public opinion survey). Other well known descriptive research methods are the case study, causal studies, time-and-motion study, and job analysis. Frequently, the mailed questionnaire is used to collect the data. The personal interview provides one of the best tools for collecting descriptive data. Direct observation or critical incidents are other techniques used to facilitate descriptive research.

3. Historical Research. Some educational problems require the methodology of historical research for their solution. Historical research involves the truthful, meaningful account in which events are examined in relation to a particular time and place. Such knowledge is important to education as it provides past practices, which when evaluated in light of contemporary situations may suggest possible courses of action at local, state, or national levels.

Historical data usually are classified as either primary or secondary sources. Primary sources of historical data consist of original documents or remains, relics, and first or "eye accounts" by witnesses of events. Secondary sources imply information which is one step removed from the primary source. The secretary's minutes of a school board meeting, for example, are primary, but the newspaper account of the same meeting are secondary. Research in the area of school law is an appropriate example of a historical study. Statutes and court decisions provide the primary sources of data and newspaper accounts and other writings the secondary sources.

Historical research reporting should be logical, properly documented, and the data theoretical or philosophical interpreted.

Can Teachers Do Research

If teachers can be intelligent consumers of someone else's research, they can most certainly do research themselves. In fact, there is a growing trend on the part of teachers to want to take part in research and especially action type research. Action research might be best defined as research that is undertaken by teachers themselves, because they believe that they can solve some of their own problems. Action research is focused on a real problem in a local setting with the thought in mind of immediate application. This implies the use of some of the informal problem solving techniques previously discussed, but action research goes well beyond mere informal methods. In fact, advocates of action research propose that research specialists serve as a part of the research team, working with the group of teachers involved in the particular study. Formal research techniques then, become a part of the methodology used. Besides standing an excellent chance of solving problems through action research, there exists through this process a number of by-products such as: in-service training and individual growth; better and closer working relationships, with other staff members; professional improvement; and a more assured chance of bringing about acceptance of change.

Action research attacks problems that are apparent at the "grass roots level." It is teacher-oriented research, carried on singly and in groups, with the ultimate purpose in mind to try out practices and ideas in a systematical and exacting manner. Methodically it is as exacting and objective as possible. Good action research will have an interdisciplinary flavor and involve "close-at-hand" specialists such as other subject teachers, the guidance counselor, curriculum director, school psychologist, and others. Such resource persons usually can make a real contribution to the attack of a local level problem.

Whether a consumer or an active researcher, each and every teacher must feel obligated to be research sophisticated. Teachers must be familiar with research findings at least in their field of specialization if they are to be professional. To ignore change in educational theory and practice is tantamount to becoming obsolescent and antiquated. To be aware of problems and accept professional change is to be astute and inspiring. □

[2] Conant, James B., *The American High School Today* (New York: McGraw-Hill Book Company, 1959).

6 Cardinal Aims of Industrial Arts

ARTHUR J. DUDLEY

□□□ A half-dozen goals forming a frame of reference for creating an instructional program for the I–A field.

Industrial arts education is both an experience and a study program that has inherent values for youth.

The experience phase is a unique factor of the program by virtue of activities that are made available to the students. These activities capitalize on the varied interests and enthusiasm of boys who come to work in the industrial arts shops.

The study phase of industrial arts represents an opportunity for the student to acquire a fundamental body of knowledge as it is applied to a series of meaningful experiences in the shop. The study should involve the discipline of facts and useful information as well as learnings about tools and materials.

The combination of experiences and study should result in the student's development of attitudes, appreciations, and understandings. A well-organized program represents a complete educational experience for the student as he assimilates content and practices tool and material techniques. A fundamental approach to the educational concepts of industrial arts must be based on the identification of content and principles rather than just an activity or the project itself.

In the belief that there are fundamental aspects representing a frame of reference within which an industrial arts instructional program can be formulated, the following are offered as six cardinal aims for industrial arts education:

1. Planning

To foster planning on the part of the students as a means of learning orderly procedures, methods of problem solving, and techniques of formulating and transmitting ideas.

Problem solving may range from the computational to the operational phases of assembly and construction of projects. Orderly procedures and problem solving in themselves are meaningless unless there is some way to express basic ideas as well as to transmit them to others. The expression and transmittal of ideas focuses attention on the need for teaching a definite body of content for drawing and sketching as a part of the total planning procedure.

2. Ingenuity

To encourage the ingenuity factor involved in the planning, construction and evaluation of the articles produced in the industrial arts shop.

Our American heritage cites many instances where ingenuity in the use of materials or the combination of principles has resulted in the successful solution of problems. Our industrial complex has placed in the hands of boys many new materials which can be used to encourage this ingenuity factor. Experimentation and research with industrial materials requires that the students be familiar with the fundamentals of shaping, forming, fastening, assembly, and finishing these materials.

3. Tool Manipulation

To demonstrate and practice tool manipulation as a learning experience.

The future home owner should have certain manipulative experiences with simple tools as a part of his fundamental learning. There also should be a concern for the improvement of the student's manual dexterity which exists in varying degrees as an inherent ability. The cultivation of inherent ability and the progress of the learning experiences can best be realized by identifying and practicing the fundamental tool processes.

4. Industrial Materials

To promote the understanding and usage of industrial materials as potential consumers and producers.

Our youth should have a sense of the plasticity, strength, texture, and adaptability of the wealth of industrial materials which surround them. Industrial materials are a part of our cultural heritage and an understanding of them contributes to our general educational complex.

5. Industrial Measurement

To assure skill and understanding in the use of industrial measurement methods.

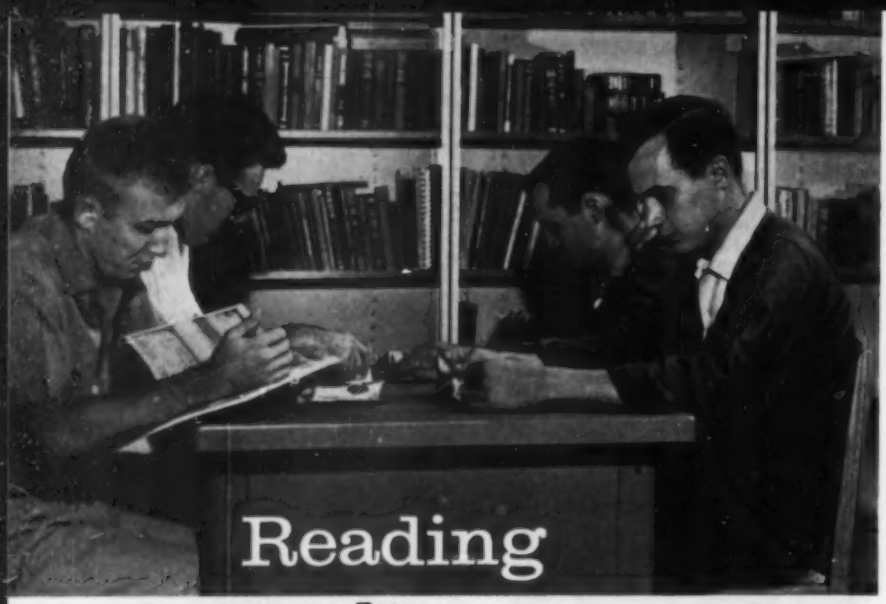
The evolvement of standards of accuracy within the realm of instruction should result from the combination of the facts of measurement and computation and the development of an attitude of appreciation of the value and use of these facts.

6. Perceptual Skill

To evolve perceptual skills and understandings related to the factual information and the practical experiences of the student.

The ability to work with abstract concepts that are a part of our technology must be developed by the students. This perceptual understanding should be projected to the development of understanding of the true worth and meaning of responsibility, perseverance, and other work habits. The perceptual ability of the student should be applied and tested by purposeful experiences using industrial tools and materials, while exemplifying the best personnel practices as he works with his fellow students in the industrial arts shop. □

Dr. Dudley is an Associate Professor, Industrial Arts Education, New York State Education Department at Albany.



Reading and Industrial Arts

□□□ *The belief that industrial arts — as a phase of general education — has a role in fostering improved ability in reading — as the basic facet of the three "R's" — indicates that I-A instructors should re-examine their teaching practices in this area.*

The following report questions Gordon Funk, supervisor of industrial education for the Los Angeles, Calif., City Schools on: (1) the modern concepts of presenting reading and how they should be incorporated into industrial arts education; and (2) how, specifically, the ten basic skills of reading are presentable in the typical I-A program.

Q. Mr. Funk, why would you say, first of all, that the reading program has special implications for industrial arts?

A. The role of industrial arts in the total pattern of general education in the secondary school certainly implies an objective for our field of reinforcing and expanding the three "R" skills. And I believe there are two reasons why industrial arts educators should expand their practices in the methods used to teach and to develop the first "R," reading. First, many secondary students, who have a deeper interest in industrial arts than in academic subjects, have achieved reading levels no higher than the intermediate elementary grades and need additional reading practice which can be gained through this motivation. Secondly, methods used to develop basic reading skills have special applications to the development of reading ability in the highly technical subject matter of industrial arts.

Q. In illustrating this role, wouldn't the changing concepts in the modern reading program provide a basis for discussion?

A. Very definitely. Before industrial arts instructors will acknowledge the point of view which involves their acceptance of an expanded responsibility for reading instruction, they must become aware of, and accept, the modern concept that there is no subject matter of reading; that all teachers in secondary education share in the responsibility for teaching reading; that the elementary school does not have the sole charge for teaching reading skills. And beyond that, the I-A instructor must accept the concept that a reading program conducted within his specialized field, is not only beneficial to the reading program but also to the subject field.

Q. What is the status of research in this area?

A. To my knowledge there is no published research available with regard to the results of a reading program in industrial arts; however, research by Kathleen B. Rudolph[1] definitely established that a reading program in the social studies area helped the student master the subject more adequately, while improving in reading skills and increasing reader comprehension. As a result of this reading instruction, pupils improved in such reference skills as notetaking, outlining, and summarizing, as well as in the ability to comprehend written materials.

Q. And you would say that this has direct applications in industrial arts?

A. It is reasonable to assume that a high degree of basic reading ability, supplemented by specific instruction in the reading skills pertinent to in-

[1] Rudolph, Kathleen B., *The Effect of Reading Instruction on Achievement in Eighth Grade Social Studies* (New York: Bureau of Publications, Teachers College, Columbia University, 1949).

dustrial arts, would find that there was growth in overall reading ability as well as a quickening of abilities in the mechanical areas. And Rudolph's study implied that such superiority in social studies content achievement can be accomplished in a similar manner in regular industrial arts instruction patterns without additional class time or additional expenditure for reading instruction.

Q. How, then, can and should industrial arts contribute specifically to reading?

A. First, let's identify the reading skills most needed by learners. Then we can demonstrate how these skills can be developed in the I-A program. A widely accepted list is that organized by Simpson in her manual, *Helping High School Students Read Better*[2]: (1) developing reading readiness; (2) reading to get the main idea; (3) reading to get important details; (4) reading to answer a specific question; (5) reading to evaluate; (6) applying what is read; (7) developing vocabulary; (8) outlining and summarizing what is read; (9) reading for implications; and (10) increasing the reading rate.

Q. And industrial arts has responsibilities for the development and application of all ten of these reading skills?

A. In varying degrees, of course. This variance is in accord with the relationship of basic reading abilities to the content field, since all subject areas do not require the same reading abilities.

Q. How does industrial arts help develop the first skill, reading readiness?

A. As used in elementary school, readiness means the organization of the instructional program in reading to accommodate the individual pupil's physical, social, emotional, and mental development and to help this pupil acquire the understandings, skills, and attitudes necessary to master the reading material presented. Reading readiness, applied on the more mature secondary school level, promotes growth in basic reading abilities and develops skills in specialized reading areas.

Q. And what techniques in industrial arts will accomplish these reading readiness goals?

A. In *labeling*, tools are identified by labels at the beginning of the semester. In *identifying* as an orientation device, such as a floor plan of the shop with equipment located and numbered, is given to the student on his first day in class. Each piece of equipment in the shop has a printed identification sign conspicuously attached. Eager to become familiar with the equipment, the student completes a numbered sheet with the name of the piece of equipment listed opposite the number corresponding to that on the floor plan. In *demonstrating*, the teacher uses the technical names of all tools, material, and equipment during each demonstration. He writes the new name on the chalkboard and uses the name in context. In *technical illustration*, a pictorial representation of tools and equipment, parts are labeled.

In addition to these techniques, reading readiness is promoted in industrial arts by the very nature of the materials and tools used. When a teacher talks about a jack plane, for example, he has one in his hand and he points out and demonstrates its function and how it differs from other planes. When the teacher discusses the wood used for building a shoeshine box, he shows samples of white oak, white pine, and mahogany. The student handles each piece and notes its color, weight, grain characteristics, strength, workability, etc. These examples for nurturing reader readiness are part of the fiber of the everyday teaching process in industrial arts. Let's go on to the second reading skill, reading to get the main idea.

Q. Does industrial arts contribute to this skill also?

A. To develop this ability, students are taught to vary their reading rates. The speed-up reading rates used to select the main ideas are known as skimming and speeded reading. This important skill is promoted in industrial arts through the use of a text book and supplemental books.

Q. What are illustrations of this?

A. One example of this is a student in auto mechanics bringing his 1954 Plymouth into the shop. He reports to the instructor that he is getting poor mileage and has difficulty starting the car when it is cold. After trouble shooting, under the instructor's direction, the student determines that the carburetor needs to be overhauled. Before the student undertakes the job, he is questioned by the instructor as to his general knowledge about carburetion, and is referred to the section in his text which deals with this subject. His assignment is to skim the article, report back on the main idea — the function of the carburetor in the fuel system of an automobile. Thus, through individual questioning, the instructor builds the need for the skill of skimming for the main idea.

Another example of the development of this skill consists of the student who, under instruction, determines that a wood project ready for finishing, needs three coats of semi-gloss enamel, and wants the color to be mellow ivory. To select a can of paint to meet the two specifications of color and degree of gloss, the student must skim the information on the label of the paint can to obtain the pertinent information which indicates how closely the paint meets the above specifications.

Q. The third reading skill, reading to get important details, would seem to have a very direct application in industrial arts. How would you illustrate this?

A. By going back to the paint can label. I believe we can show how success in developing this skill is important in, and directly related to industrial arts. This skill enables the student to follow specific directions, to organize work on an orderly step-by-step basis, and to be successful in using material according to directions. The paint can label supplies

(Continued on page 45)

"The importance of the role of industrial arts in the development of basic reading abilities is clearly evident. It must also be apparent that there are specialized reading skills peculiar to industrial arts."

[2] Simpson, Elizabeth A., *Helping High School Students Read Better* (Chicago: Science Research Associates, Inc., 1954).

Drafting or Instrumental Copying

HERBERT L. CONSTANT

□□□ *Citing differences between the two, the author states the case for "drafting" rather than "instrumental copying."*

Drafting or instrumental copying: are the terms synonymous? They are in the industrial arts departments of many schools. Although the courses in these schools are entitled drafting, the method of approach to the subject is instrumental copying. "But the end result is the same," chides the *supervisor teacher* (usually a shop teacher who has "retired" to "teach" drafting).

The author has used both methods of presentation and has found the end results of teaching the science of drafting and teaching the art of manual instrumental copying are not the same. His experience has been that the latter is neither productive nor desirable in the long run.

The Differences

Now let us find out what the difference between drafting and instrumental copying is and why the difference is important. According to all educational authorities and from experience, the author has found that rote memorization or manipulation of anything is fine if applied with only a short lapse of time intervening; it loses its value if it is not used immediately or if a new problem is to be solved. This statement gives us the insight into the dispute. Instrumental copying is the rote memorization and manipulation of drawing instruments and symbols, whereas drafting is the graphic solution of problems in one, two, or three dimensions. We cannot discredit the value of the manual manipulation of drawing instruments and rote memorization of drawing symbols for they surely have their place in the initial stages of drafting. Lettering and the alphabet of lines are examples of this. This rote memorization and manipulation can be carried to an extreme, however. From experience we can recall being required to draw the plan and section symbols for almost all the structural materials. Many frustrating hours were spent at this when Sleeper's *Graphic Standards* could have been consulted in one minute and produced the same information. By the way, even as a teacher how many of us can remember all of these symbols?

One text describes a working drawing as looking at a block from the top, side, and right end. The student then proceeds to learn mechanical drawing by copying the top, side, and right end. "That's right isn't it?" asks the naïve. Another book which is copied by many sheet metal students describes drawing a transition elbow: From 6, 5, and 4 ft. draw lines to the upper corner 8 and from 4, 3, and 2 ft. draw lines to the upper corner 8 and from 4, 3, and 2 ft. draw lines to corner 9.

Here is an example of a student being "taught" triangulation application in sheet metal drafting. How much does a student really learn through "by the numbers, draw" type of instruction? This type of instruction would be fine if we were training tracer draftsmen, and many students have won awards in local and national competition on their pretty pictures through this medium. Sometimes the students are even required to change the scale on their drawings from the original drawing in a book.

The Case for Drafting

Now that we have criticized instrumental copying let us advocate and defend the teaching of drafting. First of all, the understanding and application of certain principles of drafting is far superior to just drawing lines. These principles, if really understood, will be remembered by the student and applied to solve new problems in later life. However, let us concede a point: the student of low mental ability cannot understand principles, but may be able to draw pretty pictures if copied. Drafting, therefore, is for the analytically minded student. This may explain why so many low ability students are attracted to instrumental copying classes.

The prime principle of drafting is that of orthographic or orthogonal projection. If this principle is understood, a multi-view working drawing of any object can be accurately and readily drawn and understood. The principles involved in the relationship between the projectors, planes of projection, and the object will make meaningful such important facets of drawing as the multi-view working drawing, auxiliary views, pictorial drawings — axonometric, oblique, and perspective projections, true length problems in sheet metal pattern drafting, and other engineering problems. Other sub-principles which are essential refer to lines parallel or oblique to planes of projection or to pictorial axes. Although these principles are not great in number, they will give meaning to drawing and make theoretical tools available for solving new graphic problems.

The objectives of a subject, of course, determine the method of approach. If the objectives of a drafting course are only good citizenship, worthy use of leisure time, co-operation, self expression, and receiving five units of credit, then instrumental copying will suffice. However, if the objectives of the course are these, in addition to learning the subject matter, then the approach must be through the science of drafting.

Industrial arts educators are concerned that the quality of the students taking their classes are of increasingly lower ability. We contend that the quality of the student attracted to a class is in direct proportion to the intellectual endeavor required in the class. □

Mr. Constant is an instructor of drafting at the Berkeley, Calif., High School.

— Williamsport, Pa., Schools

How to Spotlight Your Woodworking Program

ROBERT J. CAMPBELL

□□□ *While interest may be waning in I-A woodworking in some areas, at Southwest Miami enrollment is at a high peak. Here's a report on how this enthusiasm was achieved.*

With six classes enrolling 180 students and with 200 boys on a waiting list, it is obvious that the woodworking program is enthusiastically accepted at Southwest Miami High School. In view of noticeably flagging interest in this phase of industrial arts in some areas where classes have been cut out and shops closed, the question of how this response was aroused is pertinent.

Let us establish our general background and then proceed to some simple and practical ways we have discovered to sell this program to our students. Southwest Miami High School is a large, comprehensive senior high school in a suburban area, drawing its students from a wide socio-economic range. Its curriculum includes a forward-looking academic program, an extensive business department, and a separate vocational wing — which includes electronic, machine, and auto shops.

However, the attitude of administration and faculty has always been that the woodworking shop deserves equal consideration with other departments as an integral and vital part of the total school situation. This fact alone — of acceptance rather than indifference — is a positive morale builder. Furthermore, in certain cases the woodworking shop is a definite asset to guidance and placement, for, in this atmosphere of constructive accomplishment, lies the only area of success and satisfaction for some of our students.

Mr. Campbell is woodworking instructor at Southwest Miami High School at Miami, Fla.

As in any teaching, the enthusiasm of the instructor and his willingness to put in long hours provided both initiating momentum and continuing drive. This first element of enthusiasm presupposes that the teacher is motivated not only by a love of the woodworking art and a desire to build a dynamic program, but also by a genuine concern for the needs and progress of the individual student.

Facets of the Program

Some of the concrete suggestions which have helped put our program across are:

1. We have provided small, inexpensive projects for quick results and slim pocketbooks. However, quality workmanship is definitely not sacrificed to speed in turning out such items as bread boards, tackle boxes, bowls and trays, and the water skis which are so popular here. On the other hand, where feasible, major undertakings are encouraged, some special instances involving an outlay of as much as $150. Each year we ship at least one large project to the FAIA Awards.

2. The importance of publicity and recognition for the students cannot be overemphasized. We accomplish this "advertising" by several methods:
   - *a.* Four shows in our school yearly, open to PTA and, by special invitation to parents, demonstrate both to the school and public how active and productive our program is.
   - *b.* At our annual awards assembly, along with academic and athletic prizes, we present certificates for excellence in woodworking.
   - *c.* We send a number of entries to one of the major exhibits in the country — the South Florida Craftsman's Fair.
   - *d.* We keep a display case visible to the main hall filled with attractive projects with a view to keeping our "product" in the public eye.

3. Good will is generated throughout the school by our co-operation in constructing book cases, bulletin boards, show cases, etc., where needed. This serves a twofold purpose. Our students feel they are actively helping the school in an extremely practical way and these useful contributions are often reserved for students who cannot afford to buy materials. However, this type of work is regarded primarily as a learning experience, not charity, and is never permitted to detract from attention to personal projects.

4. Finally, but equally as important as the others, is the fact that we sponsor two club programs. One extends two hours after school each week, and one is held on Saturday morning for four hours. Worthy of emphasis here is the fact that these activities are open to all students, particularly those that cannot fit woodworking into their schedule during the school day. Not only does this open up the shop for all students, but, by engendering and sustaining interest, it serves as a constant source for feeding enthusiastic students into our regular classes.

When our school opened five years ago, our program was admittedly weak with five classes of approximately 20 students each and no outside activities. We feel that because the progress made thus far has been most encouraging, it may be considered worthwhile that we share these ideas and techniques with our fellow instructors. □

□□□ *The second in a series of articles published to aid the I-E instructor upgrade the effectiveness of his practices in teaching techniques and related subjects.*

How to Write a Practical Objective Test

RUPERT N. EVANS

The first step in developing a test, as in developing any other type of educational material, is to decide on the purpose or purposes of the material you desire to prepare. The primary goal of most of education is to help the student make better and better decisions in his life after he leaves school. This is also the primary goal of tests, although teachers often behave as if the primary goal of tests were to determine what grades should be awarded to the students.

Uses of Tests

Tests may be used for many different purposes, but the teacher will usually have one or two primary purposes in mind when he designs the test. Here are a few of the more important uses of tests:

1. A test may be used to compare a student's performance against some predetermined standard. For example, the instructor may have in mind getting an answer to a question such as, "does this student have a sufficient command of my course so that he may be awarded a certificate which will allow him to handle radioactive material?" If definite standards have been established in this field, the test can be used to compare the student's performance with this standard.

2. A test may be used to compare a student's present knowledge with that which he has demonstrated in the past. In other words, it may be used to show the amount of progress which the student has made. This sort of information may be useful both to the student and to the teacher.

3. A test may be used to let the students know what the instructor considers to be the most important parts of his course. If the tests cover only minutiae such as dates, sizes, and names, the student will be justified in deciding that these are the important things in the course, and that some of the larger, more intangible things that the instructor has been talking about are not important at all.

4. A test may be used to provide what the psychologists call "extrinsic motivation." Students who are not motivated to study the subject matter for its own sake may be forced to remember, at least for a short time, through the threat of and the use of tests.

5. A test may provide a basis for organization of material which has been presented in the class. We have definite evidence that if students take a test within an hour of the time that new material is presented to them, they will retain it and be able to apply it *much* more effectively than if the test is not given at all or is postponed for 24 hours or longer. Apparently, a well-constructed test helps the student to see relationships which he probably would not otherwise discover.

6. A test may be used to teach new material. Although we rarely consider it, there is no question but that a student can learn from a test, material which has never been presented to him in any other way. This new material which he learns may be either wrong or right. Research in the field of testing tells us that students who take true-false tests in particular are apt to learn many incorrect things, since they see about as many false statements on a test paper as they do true statements. This information leads us to believe that multiple-choice questions of the "choose the answer which is unlike the others" or "choose the incorrect response" are superior to those of a more conventional type. (Fortunately, these "reverse" multiple-choice questions are also often easier to write than are questions of the conventional type.)

Use of Standardized Tests

Every school should have copies of the *Mental Measurement Yearbooks* prepared by Dr. Oscar Buros. These *Yearbooks* list standardized tests which are available, and in most cases, have critical comments concerning them. They tell you where to get the tests, how much they cost, and give you other pertinent information about them. Unfortunately, many areas of industrial education are not well supplied with standardized tests. Drafting has more standardized tests than any other area.

There is certainly little sense in a teacher constructing a test when a standardized test will provide the information that he wants and needs. You should have in your files at least one copy of each standardized test available in your field.

Preparing the Test Budget

If you can't buy a test which fits your needs, you will have to prepare one. The first step in this process is a decision as to what subjects you want to cover in the test, and how much of the test should be devoted to each subject. Perhaps you decide that about one third of the test should cover "brakes," one third should cover "cooling systems," and that there should be about one sixth each on "employment in automotive work" and "future of the automotive industry." This "test budget" enables you to avoid building a test having many questions in an area where it is easy to write questions, and few questions in an area where writing questions is difficult.

The next step is to determine how much time you have for the test, and hence, how many questions you need. Forty-five seconds is enough time for answering a multiple-choice question unless it involves considerable computation. Most true-false questions require 30 seconds or less for each answer. Thus, if you have a 50-minute period, with 20 minutes for presentation of new material, a 10-minute discussion period, and 5 minutes waste time, you have 15 minutes for the test. This would allow you to use 20 to 25 multiple-choice questions. Assuming the test budget above, you should have 7 or 8 questions on "brakes," etc.

The test budget is also a good basis for selection among standardized tests.

Preparing the Test

The easiest way to prepare a test is

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to reach into your card file of test items; pull out the cards which cover "brakes," for example, select the 7 or 8 that you need; do the same for the other parts of the test budget; and send the cards to the typist provided by the school, telling her how many copies you want and the date when you need them.

Unfortunately, this article has the word "practical" in its title, and most teachers are not equipped with a file of test questions, forgetting for the moment about the typist.

Preparing the Test Items

We know that the only way we could avoid writing or revising test items would be to inherit a test file, and teach in an area which hasn't changed for 20 years. If we are practical, we know that this situation doesn't exist.

Fortunately, you can get assistance in preparing test items. The first help which I would recommend is the book *Measuring Educational Achievement*.[1] It is an excellent source of information on the entire field of achievement testing. Although it bears a generalized title, a great deal of the material in this book is designed specifically for people in industrial education. Every teacher should have a copy of this book and should refer to it frequently as he goes about preparing tests. Because of the breadth of the subject, and because of the availability of this excellent source, this article will not attempt to describe the various types of objective paper and pencil tests.

A second aid in the preparation of test items is the student in your class. Most teachers assume that they should prepare test questions themselves, but there is no educational justification for this attitude. Students can and do prepare test questions in many classes throughout the country. This procedure gives students practice in choosing important points, and requires that they understand these points clearly if they are to make good test questions. When a student writes a question, it insures a greater amount of learning than can be obtained through a more or less passive reaction to test questions which the teacher prepares. Naturally, the student should be expected to write the answer to each question he prepares.

If students are assigned three multiple-choice and two short-answer essay questions to be written as a part of each reading assignment, you are much more likely to get good results than if you ask him to write 50 questions near the end of the term. Moreover, if your test budget is at all related to your reading assignments (and it certainly should be), then you are insuring a desirable spread of types of questions turned in by students.

Another practical point to consider is that three-fourths or more of the questions which students write won't be usable without change. Fortunately, however, it is much easier to rewrite questions than it is to start from scratch.

Duplicating the Test

Every school should provide stenographic service for its teachers. If yours doesn't, try to persuade the business education teachers of the advantages of part-time co-operative education, so you can get some help. Another possibility is your wife. She probably tells you regularly that you don't do enough things together and that she wishes she knew more about your work. If she can't type, she can write on duplicating master sheets as well as you can.

Obviously, the next steps are to administer the test, score it, award grades, and discuss the test with your students. Since your professional education courses probably covered these steps in ponderous detail, little is said about them here. Micheels and Karnes will give you considerable help with details of these steps, though they don't mention that wives seem to enjoy scoring objective tests.

Another aid in this process is the self-scoring test, which has the additional advantage of giving the student immediate knowledge of results. One type of self-scoring test can be made in the sheet metal shop. A sheet of about 16-ga. aluminum, 8½ by 11 in. in size, is punched to correspond to a duplicated answer sheet. These are made up into a "sandwich" with the answer sheet on top, then a sheet of light cardboard, then the aluminum sheet, and on the bottom, another sheet of light cardboard or opaque paper. These can be fastened together by large paper clips, or, if the aluminum is slotted near the edges, staples can be used. When the student selects an answer, he finds the corresponding space on the answer sheet and attempts to punch through it with a pencil point. If the answer is incorrect, the aluminum sheet prevents this. He then tries another answer, and continues until the pencil goes through a hole in the aluminum. The cardboard under the answer sheet prevents undetected, tentative probes by the student.

Testing the Test Items

No test is complete unless it has been checked in some way for validity. If you are following the procedure outlined here, you have completed one validity check; if you follow a test budget, you have one approach to what is called "content validity." Still another step is desirable, however: item analysis. The simplest practical type of item analysis uses these steps.

1. Score the papers and place them in order of scores, with the highest grade on top and lowest grade on the bottom.

2. Remove the top half of the pile (if there is an odd number of papers, discard the one halfway between top and bottom.

3. Take an unused test paper; above the left margin, write "high."

4. Go through each of the papers in the top half of the pile ("2" above) and place a tally mark on the unused test paper for each item which each student missed. Place this tally mark alongside the incorrect alternative which he chose.

5. On the paper from "3" above, write the word "low" above the right margin. In this column, tally all of the items missed by the students who got the lower grades.

This procedure will tell you:

1. Which items are so easy that no one missed them.

2. Which items are missed by many of the students, indicating that reteaching is necessary.

3. Those alternatives which are ineffective (if only two of the alternatives in a five-alternative multiple-choice test are used, you really have something similar to a true-false test, and should rewrite the unattractive alternatives).

4. Those test items which are missed more frequently by the "high group" than by the "low group." Almost certainly these items are ambiguous or invalid, and need to be rewritten.

A similar procedure is described in more complete detail in Micheels and Karnes.[2] They also show how you can carry item analysis much further, if you wish.

Placing Tested Test Items on Cards

As test items are tried out (and rewritten if necessary), they should be put on individual 4 by 6 or 5 by 8 cards and filed according to subject matter. Then when your next test is due, you will be ready for it with less effort.

The procedure outlined here is practical, for it is used by an increasing number of teachers. If your course has content, you need to test to see if that content has been learned. If your course does not have content, it should be eliminated from the school curriculum. Of course, the paper and pencil, objective test is only one of the types of tests which you need to use, but as course content becomes more and more technical, the paper and pencil test is apt to become even more important. □

[1] Micheels, William J., and Karnes, M. Ray, *Measuring Educational Achievement* (New York: McGraw-Hill, 1950).

[2] *Ibid.*, pp. 458–472.

Guides to I-A Design

ROBERT J. HOWE

□□□ The "notion of student designing" causes five areas of difficulty, according to the author, who proposes appropriate solutions. (The discussion is then considered by Dr. Lindbeck, with a view toward your writing your own views on the topic.)

Industrial arts in our schools has made many advances in encouraging creative thinking by individual students. In fact, we have aided occasionally the drive in education to spur students to develop self-direction and imagination. Recently, by all indications, industrial arts is making inroads — perhaps through the basement and back door — in the direction of creative designing. (This may have more far-reaching impact on general education than we now realize.)

We are continually hearing more cries of "let him solve his own design problems" or "let him express himself and encourage his special abilities." We all hope that these cries never cease, for this, after all, is the essence of an ideal education. This comparatively new notion of student designing has been thrown at us; we have caught it and we are now in a free fall with it; our chute must open soon to let us down gently and logically. When a teacher finds himself, by conviction or convention, in the position of asking all his students to design all their projects, he may very soon find himself in an absurd dilemma. If he is lucky he will fish himself out of a whirlpool of bewildering discouragement before his resulting wrath is placed on the heads of his innocent students. Once in a while a student will come along destined to be a designer. We must search him out, present him with the best and most intensive base to enter into the field of design in industry, architecture, or the crafts. However, this field is rather limited and specialized and in this article we are not referring to this category.

Mr. Howe, a graduate of the School for American Craftsmen of the Rochester Institute of Technology, is an instructor of industrial arts at the Bennington, Vt., High School.

FIVE AREAS OF DIFFICULTY

When we speak of student designing, we are truly presented with overwhelming complexity. Let us assemble this complexity into five major categories to show the areas of difficulty with which we are confronted and, later, to suggest some approaches we could take to overcome them.

1. Teacher Proficiency

It is obviously most difficult or in fact impossible to convey good designing to our students when we the teachers are not at all proficient ourselves in design. As a matter of fact those of us who may be shouting the loudest about student designing are standing, with our students, in the dark. If design can be taught, let's teach it to ourselves. This point we will leave for now with no more comment except to say that if a teacher is not constantly searching for and studying good design, this discussion is lost to that teacher.

2. Student Abilities

One of man's highest endeavors is creative thought; the more intelligent a man is the more creative his abstract thought can be. A certain percentage of our students are not capable of a considerable amount of creative thinking. This no doubt dampens our designing endeavors for a sizable number of our students.

3. Student Inexperience

This may be an oversimplification but let us say that designs for industrial products are developed in view of (*a*) function or use, (*b*) materials and fabrication, and (*c*) form or beauty. Now, an industrial arts student perhaps has some built-in notions about (*a*) function; and, if he is an upperclassman, he has perhaps an inkling about (*b*) fabrication methods; but (*c*) form or beauty leads us to an impasse as to when and where he has fortified his instinct with sound judgment in regard to good design form. We are walking here on very thin ice when we consider student designing in this light. The question arises whether to encourage bad design unavoidably because of lack of experience or to explore the feeling and construction of good design by copying, or at least paralleling, good work. A person does not become a designer or a master at his work by first telling his material what it should do, how it should be formed, and how the characteristics of the material are best shown any more than a good journalist makes up the spelling of words or construction of sentences while learning to write. He starts with a deep intensive study of the materials and methods used by experts. Lissner has said "No Genuine Artist has ever Suffered from Starting out as a Faithful imitator of his master, that this does not necessarily lead to a lifelong career of mere copying, and that individual style and originality can develop only after imitative craftsmanship has been mastered." Reservations might be made in taking this statement literally, but would let us say that a true artist must at least parallel his teacher's work before it is possible for him to make his own contribution. To master an art you must learn from a master.

4. Designing Mechanics

This point brings us to the actual mechanics of designing: graphics. When designing we find ourselves in a double problem. First, of conceiving a mental picture and then of altering and modifying that picture to reasonable proportion and construction by endless juggling and sketching on paper. It is

possible that the first step, that of visualization is somewhat developed by natural or informal education. But the second step, the skill and know-how of transferring a mental picture to an understandable multi-view drawing with dimensions, takes considerable time in training. A person needs at least a basis in this type of drawing before he may develop any kind of mechanical design.

5. Usefulness of Training

We must finally consider the reality that most of those students graduating from shop programs at present will have very little opportunity or encouragement to do designing on the job. It is most perplexing to realize how little creative expression many of our graduates will experience, except through their own special part-time efforts. To lay the groundwork for a person to develop his own design talents may be one of our most important goals, especially in view of the increased leisure time anticipated in the future.

This concludes the posing of the five basic difficulties.

I believe that there has been too much free and unrestricted casting of the idea that all students should be encouraged to design all their projects. I think original designing has been a happy new idea for all of us, especially new teachers; but I think that we have retarded our students' conception of good design by too wholehearted acceptance of this optimistic theory. After all, very little evidence has been shown that even we, the teachers, are awake and up to date concerning design. It is not my intention to de-emphasize the importance or enthusiasm recently attributed to design, but only to point a responsible constructive direction to the process.

FIVE SOLUTIONS

I would like now to review the preceding five problems with the idea of suggesting approaches to their solution:

1. Teaching Proficiency

The difficulty in our own designing would probably preclude all of the others when it comes to teaching design. Two factors seem obvious: (*a*) each individual teacher must search and keep his eyes open for the best in designed products and he must also be constantly developing his talents by designing, building, and criticizing; and (*b*) our professional journals must keep to the very highest standards of design when presenting new project ideas.

It is preposterous to present an article of topnotch inspiration on design, with excellent illustrations as examples, done by a person who can create and recognize good design, and then two pages later (in the very same journal) to present a disgracefully designed project. The biggest stride we can make in teaching design is to teach it to ourselves and the greatest help we can receive in our self-teaching will come from the professional magazines which show examples of only the best. We are in dire need of many illustrations of well-designed products in the areas of fine arts, photography, architecture, industrial items, mass-produced consumer items, and crafts. Also there are quite a few magazines outside the industrial arts field, both American and European, which are invaluable to a person interested in good design.

2. Student Abilities

This presents us with nothing particularly new or peculiar to our special subject, since differences in ability have, and always will be, our major difficulty in every phase of education. We must encourage each student to develop what natural ability he may have in original thinking, but not be insistent that everyone is capable of designing complete projects well. We find in industry a realization of this fact in that very few people are actually involved in design problems. This may seem sad to us at first, but it is a fact that everyone is

(Concluded on page 48)

a commentary

Mr. Howe makes some very pertinent observations regarding the problem of design in industrial arts; I should like to address myself to the five categories of difficulty which he has established.

1. *TEACHER PROFICIENCY* is properly placed first as a topical problem to be solved by the profession before much headway is made. Proficiency on the part of the teacher can be developed by observing and appraising products and projects, by reading and studying design literature, and by practicing designing. This is no mean task; it requires time, effort, and a willingness to submit to a critical appraisal of the things he designs. But it can be done. Until such time that the teacher acquires the confidence *to design,* he should be working toward a sensitivity to design which will manifest itself in the ability *to select* good designs. Our professional magazines do most certainly have an obligation to place before its readers only those projects reflecting the highest of standards.

2. *STUDENT ABILITIES* to design well are bound very closely, I feel, to the factors examined in category three, below. I would suggest, however, that one make no hasty judgment regarding the correlation between intelligence and creative ability. Each of us has had students of only "average" intelligence who have far outshown individuals of higher mental capabilities when it comes to creative ideas. Research in this area is not conclusive.

3. *STUDENT INEXPERIENCE* parallels those problems of teacher inexperience. Complying with the functional and material-structural requirements of a design task is generally more simple than achieving the visual "correctness" of a design. In view of this observation, perhaps the initial design efforts of students (and teachers) should be channeled in the direction of objects or parts of projects where functional-material requirements are paramount. I have in mind here such design tasks as designing methods of attaching legs to tables, of designing hinging or fastening devices, or designing tool holders, jigs, and fixtures. Such designing problems could originate in a good teacher-designed project or a good teacher-selected project. Students, in these situations, would be receiving a very valuable and most stimulating design experience which could lead to broader, more all-encompassing design tasks. The completed design for a project confronts the student with many further problem solving situations.

No one can design by copying, for designing denotes creativity and creativity originality. But I would condone copying if it would act as a stimulus to originality on the part of the student, if he recognizes that it is not his design and will credit the originator, and most important, if he understands why it is good design and can learn something from the experience. I would far prefer the good copy to the very poor original.

4. *DESIGNING MECHANICS,* or graphic representation as implied by Mr. Howe, is surely a problem but not nearly of the magnitude of the others previously examined. Perhaps clay or paper models will assist the students in visualizing their design ideas.

5. *USEFULNESS OF TRAINING* as a category of difficulty has several ramifications. Let us first understand that we are not training industrial designers. Departments of industrial design at the collegiate level are hard-pressed to do it in four years of work; we have no business in attempting to do it in less, and I cannot by any stretch of the imagination see it as a major function of industrial arts. I do, however, see the leisure pursuits as a purpose and any creative experiences we can give to the student will certainly add to their enrichment. I further believe that getting into the habit of designing and creating, of inventing and originating, and of improving and improvising, will make for a more valuable citizen, on or off the job. — *John R. Lindbeck* □

X-RAY MACHINE FOR TEACHERS

DANIEL J. CARNEVALE
La Salle Junior High School
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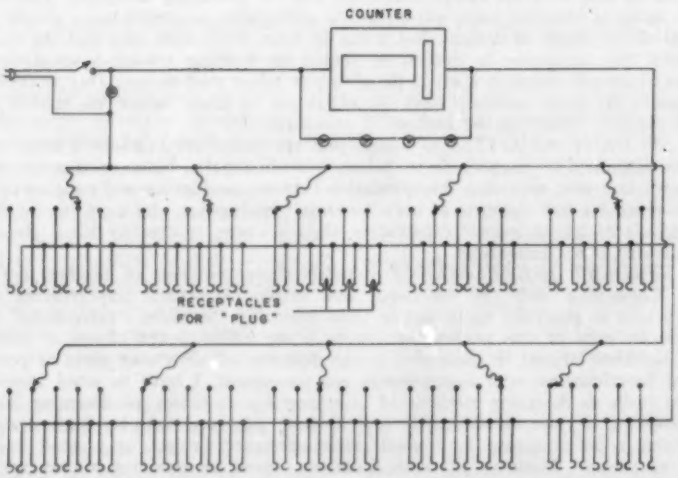
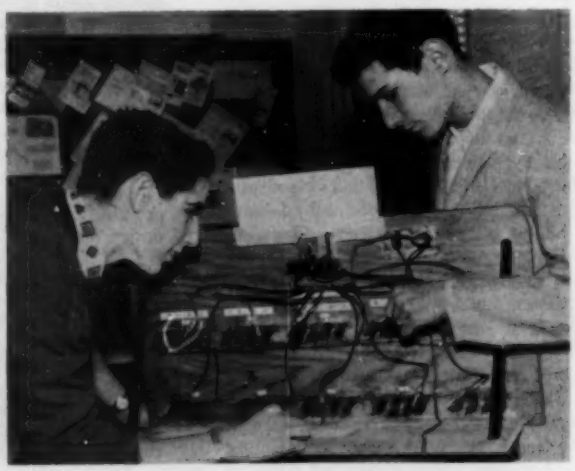


While the teaching machine is being adapted to many areas of education, by no means is it a new product in aiding learning. As far back as 1923, Professor Sidney of Ohio State University experimented with such machines. Galanter, Barlow, and Skinner are but a few educators who have been recently trying to utilize the machine more to meet the ever growing demand for efficient learning aids. Within the past few years, several manufacturers have produced in limited quantity, many different types of machine aids, some of which sell for as much as $6,500 each.

Industrial arts teachers not only use the teaching machine to aid as a teaching or diagnostic device, but also their pupils can benefit from the actual construction of such a machine.

A machine constructed by eighth and ninth grade pupils at La Salle was a joint effort of not only the mechanical drawing, wood shop, metal shop, electric shop, and print shop, but also involved the science department on a consultant basis.

Why the name "X-Ray Machine"? Prior to its conception, during an in-



formal after-school talk, the course of discussion centered around the theory, "Why can't teachers have an X-Ray machine, as doctors do?" Naturally, the difference of locating a broken bone by X-Ray and a weak area in a student's learning were explained to be completely different.

The explanation didn't seem to completely satisfy five boys. They argued that with the advent of electric machines in so many phases of life, there should be a machine that could find a weak learning area just as the doctor uses the X-Ray to find a break in a bone.

After a number of conferences, it was agreed to build an electronic instrument. It would test quickly the various areas of learning in mechanical drawing, such as: shape description, size description, types of lines, and symbols.

Knowing that local industry had contributed surplus electrical parts to our school's supplies, we inventoried what we had and proceeded to make a schematic diagram of our machine. Working drawings were also made for a cabinet to house the electrical parts. Each boy was assigned a responsibility for a certain part or parts and, with the cooperation of the shop teachers, completed his part of the project.

There were ten questions which were to be multiple choice in each area. Each question would have four answers to choose from and could be changed easily by inserting new questions in two slides on the front of panel. Old switchboard receptacles were used with a switchboard type "plug." Through the use of alligator clips it would be possible to change the correct answer to a, b, c, or d for different areas or tests. If the pupils were proficient in the area, that area would be bypassed. If, on the other hand, he scored low, in one area, it would be similar to the doctor locating the break in the bone. From there it was the teacher's responsibility (as the doctor's) to aid in mending by way of review in that area.

The construction of the machine was not to be complicated, but the end result would be far reaching in aiding the pupil who was deficient in a subject area.

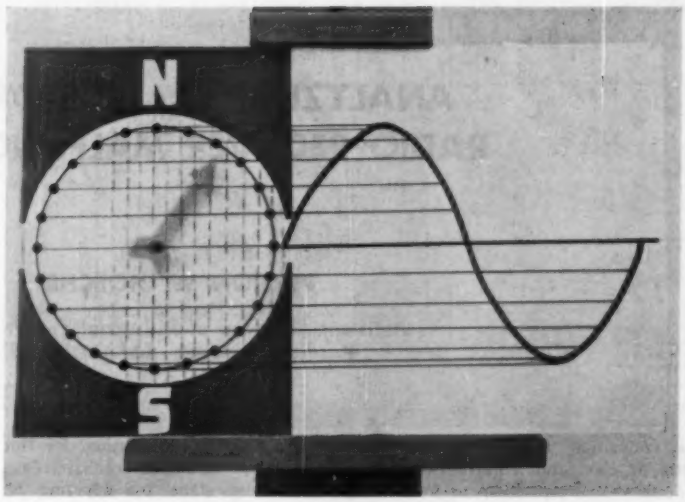
It would isolate the weak areas of learning quickly and also reward, to a degree, by letting the pupil know he was correct. This would be accomplished by a set of lights lighting only when a correct response was given.

After several months of developing questions, the "X-Ray Machine" or "diagnostic machine" became a reality and in the past half year has aided many boys in mechanical drawing.

Other subject teachers have used the machine (substituting their own questions) and have high praise for the results.

One of the most encouraging factors is that it gave more meaning to industrial arts as a subject. It correlated the various shop areas and made the boys realize what could be accomplished with the proper knowledge of theory and tools. □

aids in teaching electricity



AID FOR TEACHING SINE WAVE GENERATION

ISAAC P. HAMPTON

When the student first encounters the a.c. sine wave form, he is apt to ask this question: How did it get that shape? The fact that the sine wave has a characteristic form which is similar under all normal circumstances is of significant interest. The importance of sine wave a.c. to all studies of electricity demands that a comprehensive knowledge of its characteristics be attained. If the student has access to a model dynamo and/or an oscilloscope, the method by which the a.c. is generated can be rather simply illustrated. The following aid will also help the student's understanding of a.c. sine wave generation.

The accompanying picture of this teaching aid illustrates that the panel is of ⅛ by 16 by 36 in. tempered hardboard. A base coat of white latex paint provides a good surface for the India ink line work. The arrow, which is made of transparent plastic, is free to rotate in a full circle. The point of the arrow is used to indicate the successive positions of a conductor rotating in a two-pole field. Flux lines between the two poles are shown as broken lines.

Using the Aid

The aid may be displayed after the concept of inducing a current by relative movement between a magnetic field or a conductor has been explained. As the instructor moves the pointer to different positions, the student can see that the flux lines are cut at constantly changing angles. If the pointer assumes to turn at a constant speed, the intensity of the induced current will be dependent upon the density of the field being cut. Maximum density will occur at 90 and 270° counterclockwise rotation. The zero line, or point of no current flow, will coincide with the point where the conductor is traveling parallel to the flux field, or at zero and 180°.

Instantaneous values of current may be plotted through a complete rotation. A line drawn through these points will then become a sine wave. One rotation gives a complete set of positive and negative values, or one cycle. The division of a cycle into 360 electrical degrees is also conveniently illustrated with this teaching aid. Points which may be emphasized include: (1) positive and negative values of current, (2) instantaneous values of current, (3) cycle, frequency and period, (4) effect of rotational speed on frequency and amplitude of generated wave, and (5) in-phase current and voltage. □

□ *Shop notes for teaching electronics in the Sixties —*

ANALYZING TRANSISTORIZED RADIO RECEIVER MALFUNCTIONS

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Purdue University, Lafayette, Ind.

Anyone concerned with the proper functioning of electronic equipment is always faced with the problem of finding a defective or malfunctioning component in modern electronic equipment in the most expedient way. With the advent of miniaturized and transistorized equipment, the problem has indeed multiplied. Advancements in the application of semiconductors in electronics is increasing at such rapid rates that one is continuously confronted with unfamiliar circuits. The technique of relying largely on the sense of smell, sight, touch, and on past experience is obsolete and will no longer do the job. Since a transistorized radio receiver contains so many of the fundamental electronics circuits, it is chosen here as a basis of study.

In trouble shooting an inoperative transistorized radio the most effective procedure which will systematically locate a defect with great speed and efficiency is signal substitution. By this procedure, the defect is localized to a malfunctioning stage by applying an appropriate substitute signal at strategic points within the receiver. Having found the malfunctioning stage, the defective component can then be located by making successive voltage and resistance measurements in that stage and comparing them with norms that are recommended by the manufacturer of the particular equipment.

To implement this method of trouble shooting, it is necessary that the repairman understand what a stage is composed of and its function. Figure 1 is a schematic drawing of a standard transistor receiver that is commonly used by most manufacturers with perhaps a few modifications. This receiver can be broken down into a block diagram as illustrated by Figure 2. Each block represents a stage and each stage consists of a transistor with its external circuit.

Troubleshooting a transistor receiver with a signal generator and vacuum tube voltmeter.

The wave forms are shown in Figure 2 illustrating how the different stages alter the signal from the time it enters the antenna until it is emitted as an audio note at the speaker. The functions of the various stages can be tabulated as shown below.

Converter Stage

1. A received signal (any radio station signal) which is picked up by the antenna is selected by the tuning circuit (L1 and C1) and is fed to the base of the converter transistor Q1.
2. A local signal is generated by the oscillator circuit at a frequency that is 455 kc. greater than the received signal and is fed to the emitter of transistor Q1. (See Figure 3.)
3. A constant frequency difference of 455 kilocycles (intermediate frequency, IF.) is maintained between the oscillator signal and any signal to which the receiver is tuned.
4. The signal is amplified and passed on to the next stage.

I.F. Stage

1. The modulated IF signal is accepted from the converter stage, while all other signals are rejected. This is accomplished by the tuned circuits of the IF transformers, T2, T3, and T4 which are tuned to receive only the intermediate frequency signal, 455 kilocycles.
2. The modulated IF signal is amplified and passed on to the next stage.

Detector Stage

1. The audio component is removed from the modulated intermediate frequency signal. This process is referred to as "demodulating the signal" which is accomplished by the rectifying action of the detector diode. This action is illustrated by the input and output wave forms of the detector stage in Figure 2.

Audio Stage

1. The audio signal is amplified to an amount sufficient to operate the loudspeaker.

Locating the Defective Stage

Having learned the function of each stage with its input and output wave forms, we are now ready to find the defective stage. The only instrument that is required is a common signal generator that generates the various wave forms. The appropriate wave form of the signal generator will be injected at strategic points (test points) which are numbered (see Figure 1) beginning at the speaker end and finishing at the antenna. The sequence of the numbers is the order in which the testing should take place.

The signal generator "hot" probe is connected in series with a 0.1 MFD capacitor to each test point. This will prevent the shorting out of bias voltages which may damage the transistors. The base of a transistor, which corresponds to the control grid of an electron tube, is the signal input terminal. The collector, which corresponds to the plate of a tube, is the signal output terminal. The emitter is the common terminal which corresponds to the cathode of a tube.

Allow about ten minutes for the signal generator and the radio receiver under test to warm up. With the radio volume control turned up to maximum output, commence the test as follows:

Test point 1. Apply an audio signal from the signal generator, with output on full, to test point 1. If an audio note is heard from the receiver, though very weak, the speaker can be assumed to be functioning normally.

Test points 2 and 3. Apply an audio signal, if an audio note can be heard, although somewhat weak, the second audio output stage can be assumed to be normal.

Test point 4. Apply an audio signal to this point. A stronger audio note will be heard from the speaker if the second audio amplifier stage is normal.

Test point 5. Apply an audio signal. A loud, clear audio note will be heard if the first audio frequency stage is functioning normally.

Test point 6. Apply an audio modulated IF. signal to this point. A weak audio note will be heard if the detector stage is functioning normally.

Test point 7. Apply an audio modulated IF. signal. A stronger audio note will be heard if the second IF. stage is normal.

Test point 8. Apply an audio modulated IF. signal. A very strong audio note will be heard if the first IF.stage is normal.

Test point 9. Tune the receiver to 600 KC. Apply an audio modulated R.F. signal tuned to 600 KC from the signal generator to this test point. A full strength audio note will be heard if the converter stage is functioning normally.

Analyzing the Malfunctioning Stage

By following the above procedure, the defect in the receiver can be localized to the defective stage. The next and final step is to locate the defective component in the stage so that it can be replaced or repaired. To do this a vacuum tube voltmeter is required in order that voltage checks can be made at the transistor elements and at other points in the external circuit, as indicated on the schematic drawing. As a basis for interpreting the voltages measured, the technician should have norms for comparison. Manufacturers usually include voltage data on the schematic diagrams of the transistor radio receivers. If the voltages measured from the transistor elements to ground differ from the manufacturers rated voltages, trouble is indicated in the transistor or its external circuit. Proper interpretation of the readings will usually indicate the nature of the defect. The suspected component may then be tested or a substitution of the component known to be good can be made.

In making voltage checks due caution is advised because it is possible to damage transistors and the associated components. As, for example, the test probes of the meter may slip off the terminal and cause a short between the crowded adjacent points or lines which could result in excessive current flow thereby destroying the transistor.

Resistance checks are also helpful in locating defective components, if the limitations of such a check are recognized. Resistance measurements in transistor circuits are not always meaningful in revealing the true conditions of the external circuit, because the energizing battery in the ohmmeter applies a voltage to the circuit causing current flow in the transistor. To avoid this, it may be necessary to unsolder one lead of the suspected component to properly measure its resistance.

As a person gains experience in servicing transistorized radio receivers, there are short cuts that may be used. It will be found that this system of localizing the defect is modern, logical, and systematic. It will save much valuable time as one grows accustomed to using it. □

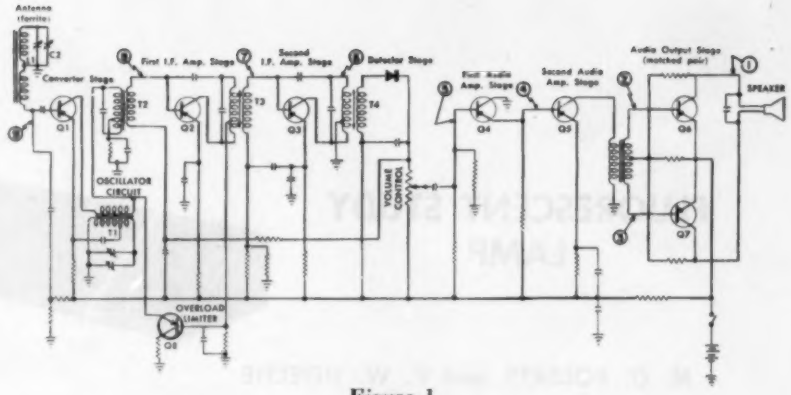

Figure 1.

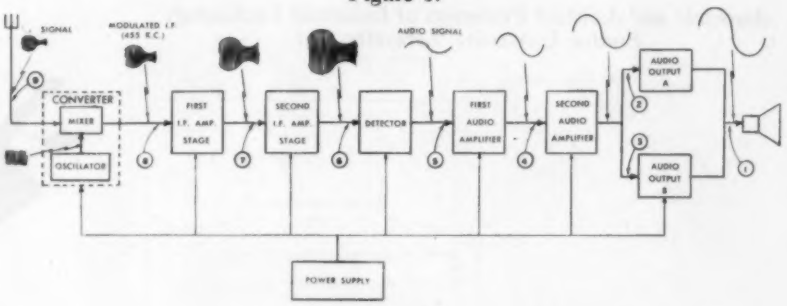

Figure 2.

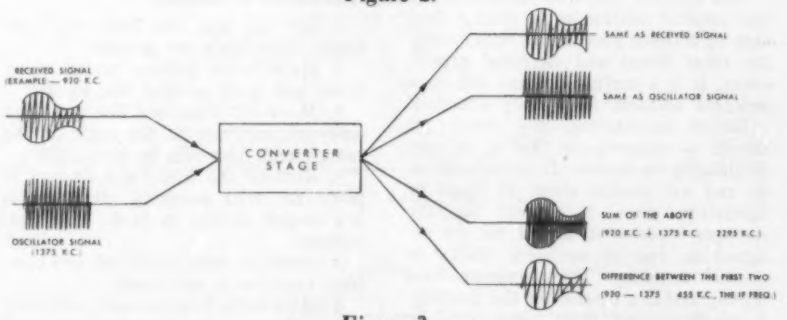
RECEIVED SIGNAL (EXAMPLE — 920 K.C.
OSCILLATOR SIGNAL (1375 K.C.)
CONVERTER STAGE
SAME AS RECEIVED SIGNAL
SAME AS OSCILLATOR SIGNAL
SUM OF THE ABOVE (920 K.C. + 1375 K.C. 2295 K.C.)
DIFFERENCE BETWEEN THE FIRST TWO (920 — 1375 455 K.C., THE IF FREQ.)

Figure 3.

FLUORESCENT STUDY LAMP

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This project, prepared to co-ordinate two areas of interest in the general shop area of activity provides an opportunity for sheet metal and electrical experiences. It is a useful item and will be a welcome addition to a study situation.

Before introducing this project it should be pointed out that it is very challenging in nature. It is difficult to do and will require about 25 hours of laboratory time. A project for the stronger student, it should not be assigned to one of mediocre ability in manual dexterity. The aluminum base represented is a product of the foundry. A substitution of sheet metal could be made, but a solid aluminum or iron casting is desirable for weight and balance.

The instructions furnished are quite detailed and should be followed closely. They have been used for making dozens of lamps. Results will be sure and dependable if they are followed closely. If so desired, the automatic starter can be replaced by a dual purpose push button switch. If this is done a .01 mfd by 400 volt tubular capacitor should be inserted between points "X" and "Y" of the fluorescent tube as shown in the wiring diagram.

Fabrication of Canopy Ends

1. Using one side and one end for reference make layout as shown.
2. Cut closely to lines indicated in layout. *Do not use file.*
3. Make an end forming block of wood and lay carefully over section. Clamp in vise.
4. With hammer tap curved portion around first, then continue.
5. Be sure bends on one end are opposite from the other end.

Fabrication of Canopy

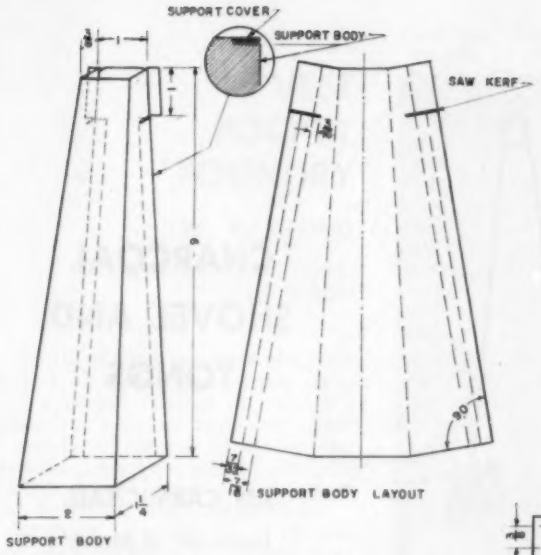
1. Lay out first two lines for front bends. Omit back for present.
2. Place larger portion under apron brake and bend on first line to 90°.
3. Move out to second line and bend only sufficiently to fit the angle on the canopy end. This will be about 120°.
4. Remove the brake and fit end in place for trial assembly. If angle is not enough replace in brake and bend further.
5. Insert in sheet metal roll and complete curve to fit end form.
6. With body fitted around ends mark points at each end where last 90° bend is to be made.
7. Partially flatten out so main portion of canopy may be inserted under brake to obtain bend along narrow margin.
8. Insert in sheet metal roll again and reform curve.
9. Work final curve into place by hand until ends of canopy are held firmly in place without aid, and ends flush with body portion.
10. Proceed with spot welding.
11. Make spot welds about 5/8 in. apart around the ends of the canopy.
12. Now insert end forming block in end, mount in swivel vise and gently tap body portion around firmly against end with light tapping hammer.
13. File down carefully, then follow up with emery cloth until the end appears to blend in as part of the body.

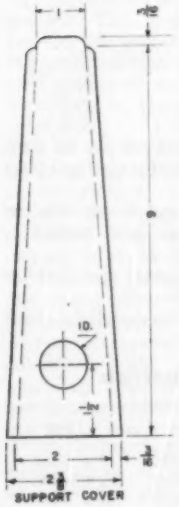
Processing Base

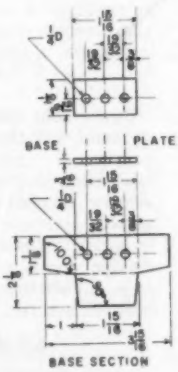
1. Round off all sharp corners to prevent paint wearing away.
2. Lay out holes to be drilled and tapped, according to sketch.
3. Proceed with drilling holes called for.
4. Tap holes called for. Use oil when threading aluminum, reverse direction of tap ½ turn for each full turn forward to keep cutting edges free and prevent clogging and breakage.
5. Obtain base plate. Cut and fit into recessed portion on bottom. Punch and countersink mounting holes. Procure short flat head screws for mounting.

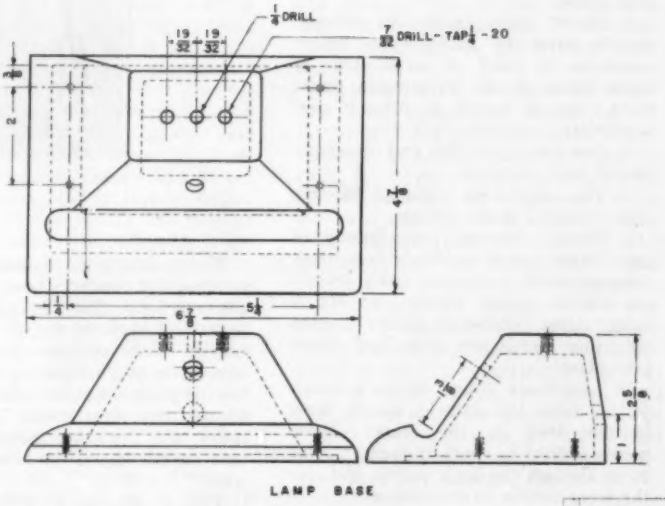
Fabrication of Upright Support

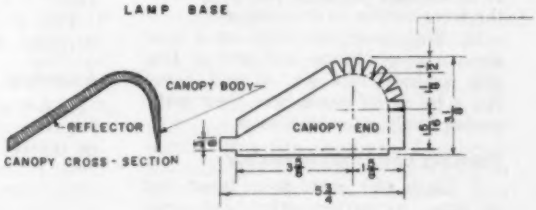
1. Lay out aluminum piece and drill holes called for. Hold in drill press vise while drilling to avoid injury.
2. File down to layout lines. Do not grind on grinder.
3. Lay out small piece of sheet metal for bottom section.
4. Punch three holes called for and cut to form.
5. With two ¼ in. cap screws and lock washers bolt the sheet section in place beneath the aluminum plate. Open section should be at rear of lamp base. Bend sides up to fit support.
6. Lay out and cut largest section of support as shown.
7. Clamp between two metal blocks in vise and saw kerf with a fine tooth hacksaw to remove metal. *Do not cut with snips.*
8. Procure thin strips of aluminum. long ¼ in. rectangular bars, and bend on combination brake.
9. Order of bends — (a) two outer bends back on opposite side from layout, insert strips and hem on brake, leave thin strips in hem; (b) with narrow portion just hemmed under brake bend on second line, this time with layout lines up; and (c) insert, in brake

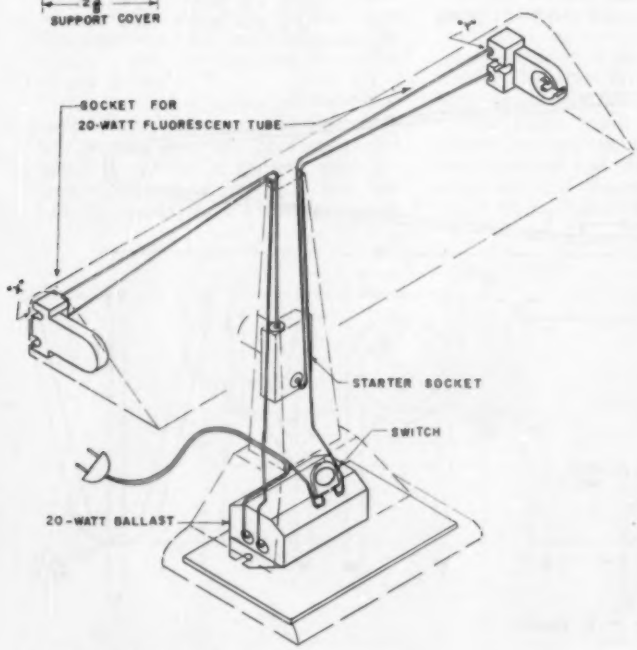

SUPPORT COVER
SUPPORT BODY
SAW KERF
SUPPORT BODY LAYOUT
SUPPORT BODY

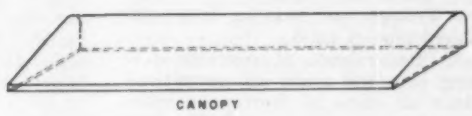

SUPPORT COVER

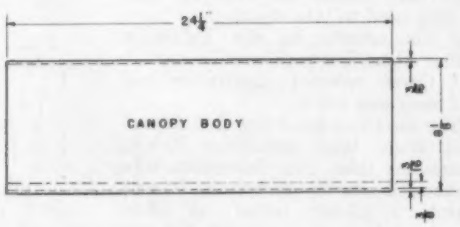

BASE PLATE
BASE SECTION

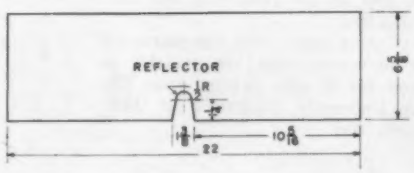

DRILL
DRILL - TAP - 20
LAMP BASE


CANOPY BODY
REFLECTOR
CANOPY END
CANOPY CROSS - SECTION


SOCKET FOR
20-WATT FLUORESCENT TUBE
STARTER SOCKET
SWITCH
20-WATT BALLAST


CANOPY


CANOPY BODY


REFLECTOR

on third line, rectangular bar and, holding brake with right hand, lift apron with left hand and form a third 90° bend.

10. Remove strips and clamp in vise between two long bars and form welding tabs on upper end.

11. Lay out, cut, and bend back cover by inserting strips to form hem in same manner.

Assembly and Wiring of Lamp

1. Assemble parts together and see if lamp sets square on base.

2. When all is square and straight, first, weld canopy to support.

3. Recheck again on base for squareness. If square, weld to base portion.

4. Mount starter socket in back cover. Cut threads in socket body to hold screw.

5. Mount tube sockets in canopy. Attach wires to each screw before mounting in place. A small strip of thick metal should be inserted under front edge of socket to keep it perpendicular to canopy back.

6. One wire from each end of canopy should stop at starter.

7. The other two wires go through hole in base and out bottom.

8. Obtain 20-watt size fluorescent tube. Insert in canopy. Make temporary connections of component parts, including switch. Insert starter and see if lamp lights. Remove starter socket mounting screws and slide back cover into place.

9. Locate six points on back cover, ½ in. from top and ½ in. up from bottom, then in the center. These points should be near enough to edge to go through the back section and also the front section of the support.

10. With lamp face down on a large area to keep canopy and base in line, drill six holes with No. 40 drill. Screw No. 4 by ⅜ in. round head sheet metal screws firmly into these holes.

Painting and Final Assembly

1. Clean with metal-prep. Insert wad of paper in starter socket, and cover lamp sockets with tape.

2. Proceed with painting lamp with desired type of finish.

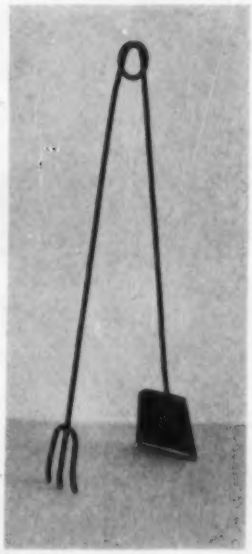
3. Place balance of components in lamp base and solder all connections. Make all wires as short as possible. Tape bare connections well. Tie knot in lamp cord to take strains.

4. Cut reflector to size. Polish on buffing wheel. Use goggles.

5. Curve reflector slightly on roll and snap into place.

The electrical parts for this fluorescent study lamp include a 20-watt fluorescent tube, two fluorescent tube sockets, a starter socket, a 20-watt starter, a 20-watt ballast, an off-on switch, and an a.c. cord with 110 volt plug attached.

All of these parts, with the exception of the fluorescent tube, are available in kit form for $3 plus postage from the Purdue University Bookstore at West Lafayette, Ind. □



CHARCOAL SHOVEL AND TONGS

JIM CARMICHAEL

Instructor in Metals
North Eugene, Ore., High School

The modern home, outdoor living, and camping has created a need for new and different tools. The charcoal shovel and tongs has been developed as a simple answer to the outdoor chef's needs. It also serves as a simple beginning project for the general metals student who needs to perform sheet metal layout procedures, use the sheet metal break, and gain experience on the bender and spot weld.

This is also an excellent project to introduce mass production methods.

Assembly Procedure

1. Lay out, cut and fold the shovel.

2. Cut wire to length and form spring on the bender.

NOTE: The spring or coil can be made by hand with the aid of a vise and piece of pipe.

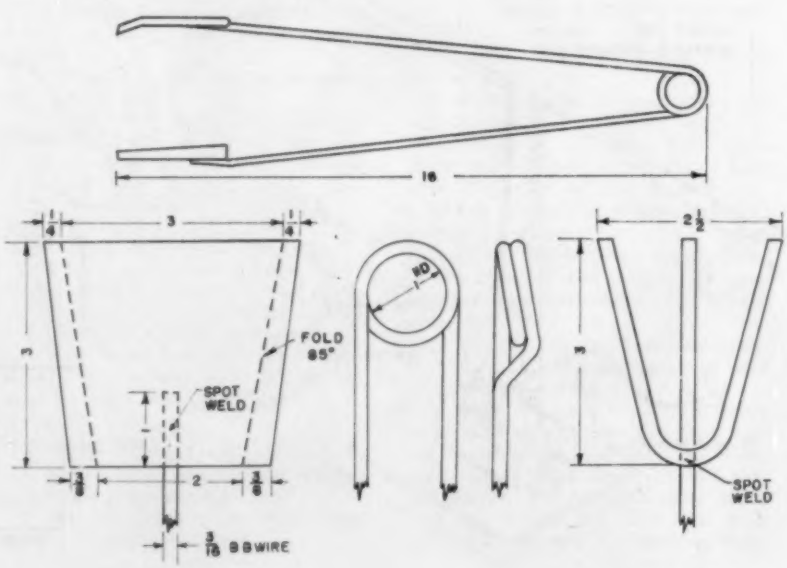
3. Heat in forge and flatten the end of the handle to be spot welded to shovel.

4. Form the tongs and spot weld to handle.

5. Finish with primer and flat black enamel. □

Bill of Materials

Quan.	*Material*	*Size*
1	22 ga. black iron	3 x 3 in.
1	3/16 in. B.B. Wire	3/16 x 38 in.
1	3/16 in. B.B. Wire	3/16 x 7 in.



A VEST POCKET FOUNDRY

W. H. CLOUD

Principal, Crawford, Colo., High School

Almost all boys are charmed by the process of melting and pouring metal into a desired form or, in fact, into almost any form, no matter how crude it may be. In order to substantiate this statement, you have only to recall the childish interest which you may have had in melting and pouring lead.

Education is predicated, at least in part, upon the theory that interest plays an important part in the learning process. The field of industrial arts foundry has long been an interest getter, but space and the expense of the necessary equipment has made it impractical to include in the majority of the I-A curriculums.

If we are to give more than lip service to our stated objective of providing an exploratory experience in a wide variety of industrial principles and processes, some experience in pattern-making, in molding procedures, and in the melting, pouring, and finishing of cast metal should be presented. From the standpoint of interest and as a medium of expression, cast metal offers not only a wide variety of experiences which are essentially satisfying to the boy but, in addition, offers an inexpensive media which may be easily adapted to any ability level and be within the interest span of the individual. Short term projects are the rule rather than the exception, yet variations can be offered which will challenge the ability of any student.

Upon several occasions the writer has used foundry equipment, most of which had been designed and produced in the school shop. This equipment, while effective, was of conventional size and had the disadvantage of occupying too much space in an already crowded shop. The idea of a miniature foundry with changes in both the size and shape of flasks and other molding tools was a gradual development. It started with tin cans in a variety of shapes having the bottoms removed and used as forms in the making of plaster casts and molds. These forms became flasks by the simple addition of another can of the same size and shape with soldered prongs and loops to hold them together and in line.

Somewhere during the process of development someone in need of a small sand mold used one of these tin can flasks. Since, for small articles, they were much more efficient and economical in their sand requirements and ease of manipulation, the tin can flasks were soon being used more than those of conventional size. With the wide variety of market offerings in the size and shape of food containers, it is an easy matter to produce a flask for almost any desired purpose. All that is needed is two cans of the same size. In our case preference has been given to those which are relatively shallow and do not require re-edging and cutting in height. Since some of the smaller fish product cans are of aluminum, difficulty might be experienced in fastening the loops and prongs, and riveting must be resorted to. In all other respects these aluminum cans are much nicer to handle than those constructed of tin plate.

The use of small flasks demanded other molding tools of reduced size. These, while makeshift at first, became well-made miniatures as the boys had the time and incentive to make them. The complete set of molding tools fits into a cigar box with plenty of room to spare. The sand bin is a 12 by 14 by 3 in. baking pan and holds around ten pounds of sand. Molding boards are of ⅛ in. Masonite cut to fit into a cigar box. The bellows is a plastic glue bottle with a ⅛ in. plastic tube (source unknown) cemented into the cap. A small, rubber, bulb-type syringe would probably be superior.

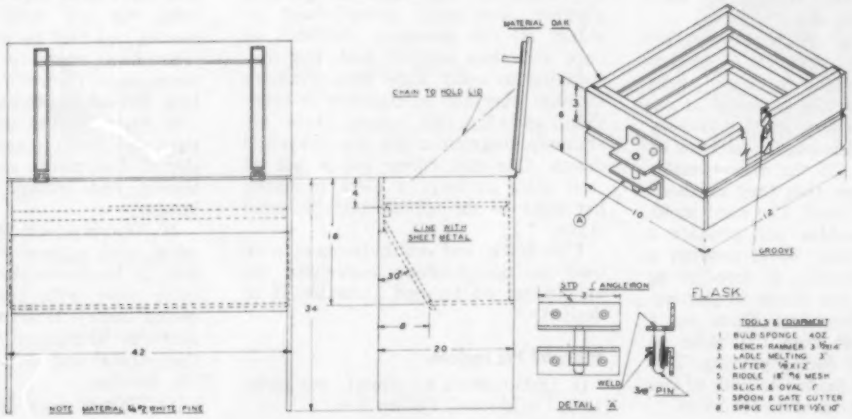
The riddle (sand sieve) is a large tinned sardine can with top and bottom removed and screen wire soldered over one end. Sprue pins were made from ¼ in. dowel chucked in a small electric drill and tapered with a file. Sprue cutters are short pieces of ⅜ in. copper tubing. A spoon shaped leather modeling tool and fine camel hair brush serve for mold repair. The modeling tool is also used for gate cutting and as a tool to assist in removing patterns from the sand. The most important tool, the rammer, was made from a piece of ¼ in. dowel glued into two pieces of broom handle which had been shaped as per diagram.

A plastic doll nursing bottle is used as a water sprinkler for mold repair. Chimney soot or rotten stone tied in a cloth of rather coarse weave serves as a parting compound. Where a very detailed impression is desired, the pattern is lifted and the cavity is dusted lightly with powdered graphite before replacing the pattern. This method is especially good in the reproduction of commercially made articles which have many fine details.

Molding sand is an extremely important consideration and should be obtained from a good commercial source. Seldom can a good sand be found locally. In a pinch, however, a fair sand may be produced by tempering the fly ash produced by stoker type furnaces with molasses and water. While the quality of this sand is nothing to rave about, it will produce usable castings.

The making of patterns can be a source of detailed work in which a gifted student may spend as much time as he wishes in the construction of fine jewelry, scale models, and small machine parts — or the average or slow student may reproduce an article for which someone else has made the pattern. In either instance, the student is limited only by his ability and he is able to develop a feeling of satisfaction and personal worth. Various materials, among which are wood, clay, soap, plaster of Paris mixed with hot paraffin wax, and pure beeswax may be used as a media for making patterns. Experience has indicated that the last two seem to meet our needs best. They are both easily worked with a pocket knife and can be melted and used again. Both are ideal substances for teaching the principles of draft and shrinkage allowance.

In the melting of any metal, safety is of prime importance and many of the



basic facts of the physical sciences may be demonstrated. Lead and its alloys are, of course, the most easily handled of all the metals. Not only do they melt at a relatively low heat but they may be finished with ordinary woodworking tools. Their disadvantage is in the weight and softness of the casting. The matter of softness can be corrected through the addition of some of the so-called "Pot Metals" which are rather brittle and give a grain structure which resembles cast iron. The actual melting of lead alloys is easily possible with almost any common source of heat and in a wide variety of melting containers. We use a gas flame, a gasoline torch, or a coal forge depending upon which is the most convenient at the moment. The melting ladle is a small cast iron (plumber type) vessel which can be purchased for a little over a dollar. Our source of lead and its alloys is the scrap metal yard, where lead pipe and castings, old type-metal, battery plates, and pot metals are available at a cost of a few cents per pound.

Aluminum, while much more difficult to melt than lead, does produce a light strong casting. It is possible to melt it on a coal forge using a graphite crucible or a home-made cast iron vessel. Ours is a 3 in. section of a 4 in. cast iron pipe with a welded cast iron bottom. A section of cast iron tractor sleeve handled in the manner indicated above makes another good source of material for the construction of a melting pot. Any form of scrap aluminum, except magnesium alloys which will burn with explosive violence when heated, may be used for melting. Generally speaking, the heavier pieces of scrap are better for melting purposes than the lighter stock from kitchen-ware and sheet aluminum scrap. Due to the formation of slag, most of which is aluminum oxide, there is a great deal of waste during the reduction of aluminum into its molten state. This material must be removed before pouring into molds. Addition of powdered borax or a small amount of a good brazing flux to the crucible will tend to hold down slag formation and improve the quality of the casting.

It is in the field of silver casting that the small sized foundry equipment really reaches maximum efficiency. Here, there is seldom if ever any need for either a large flask or crucible.

The production of silver jewelry through the use of natural patterns such as leaves, insects, twigs, and shells when coupled with the potential of designed patterns offers infinite variety for the use of either plaster of Paris or lined sand molds. If the plaster molds are used make sure that they are bone dry before being used. The sand mold, if lined with graphite, will produce a very detailed casting. Silver requires a high heat to produce a free-flowing liquid which will not freeze in pouring. We use an oxyacetylene flame on a small crucible and keep the flame on the molten metal during pouring. This requires the co-ordinated activity of two students during the pouring operation. □

project design sheets

FIREPLACE TOOLS

GILBERT R. HUTCHINGS and JOHN R. LINDBECK

Associate Professors of Industrial Education
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This very functional and striking fireplace set was designed for the contemporary setting; the simplicity of shape and combinations of materials provides an interesting departure from the typical sets conceived in a somewhat more traditional vein.

Note the achievement of visual unity by the employment of the triangle in the three pieces; the identical handles reinforce this feeling of unity-among-elements. A note of emphasis obtains by way of the contrasting surface treatment of the black pieces and the white handles. The clever hanging device is simple yet effective, for the slightly bent corners of the slots prevent the tools from crashing to the floor when accidentally bumped.

The suggested plan of procedure, below, is organized to facilitate construction; most of the operations involved in completing one tool are grouped together. One may, instead, wish to obtain all the necessary materials at once and then proceed with the construction in order some time. Foundry facilities may not be available in every shop, and for this reason there are alternate suggestions for the poker-end design. One can either cut it out of steel plate or forge a piece of heavy bar stock to the approximate indicated shape.

Flat black and white lacquers were used as the finishing materials; the handle can be finished naturally, if so desired.

Plan of Procedure

1. Obtain stock for shovel: one piece, 18-ga. mild steel, 5½ by 5 in.

2. Lay out pattern for shovel on the metal stock indicated in drawing; cut with tinsnips and remove all burrs with a file.

3. Bend up the sides as per the drawing.

4. Obtain stock for shovel stem: one piece, ¼-in.-diameter mild steel, 13½ in. long.

5. Thread one end, bend other, as per the drawing.

6. Assemble the shovel and the stem and braze together as indicated in the drawing. The pieces should be properly aligned and clamped in place prior to brazing.

7. Obtain stock for poker end: a wood pattern must be prepared, rammed, and cast in brass as suggested in the drawing. If foundry facilities are not available, ¼-in. steel plate may be substituted for the poker end; in this case the outline may be laid out on the steel, cut out with a hacksaw, and ground and filed to shape.

8. Obtain stock for poker stem: one piece, ¼-in.-diameter mild steel, 15 in. long. Thread one end as per the drawing.

9. Assemble the poker end and the stem and braze together. As with the shovel, the pieces should be properly aligned and secured in place before brazing.

10. Obtain stock for brush: suitable wood brush replacement units are available in hardware stores (but may require some lathe turning to the suggested shape). If necessary, the existing hole can be plugged with a dowel and then drilled and tapped as indicated in the drawing.

11. Obtain stock for brush stem: one

piece ¼-in.-diameter mild steel, 14 in. long. Thread both ends as per the drawing.

12. Screw the wooden brush onto one end of the stem. Tighten.

13. Obtain stock for handles: three pieces of birch or some other close-grained hardwood, 1 by 1 by 5½ in.

14. Locate the centers on the ends of the handle stock; cut diagonals in one end of each with backsaw, about ⅛ in. deep.

15. Mount one piece in wood lathe, and turn to shape as per the drawing. Make certain that the 1-in.-diameter end is toward the headstock. Sand smooth with 80 grit followed by 120-grit paper. Then, with lathe turned off, sand gently with the grain using 180-grit abrasive paper.

16. Replace live center with a chuck containing a No. 7 twist drill. Turn work end for end and drill hole to depth of 1 in.

17. Return live center to lathe; cut the handle to length and remove from lathe.

18. Prepare the other two handles in the same way.

19. Tap the holes in the three handles.

20. Obtain stock for hanger: one piece, 18-ga. mild steel, ¾ by 1¼ by 6 in.

21. Cut bevels and slots as per drawing.

22. Bend to shape; also bend up the slot corners slightly, as per drawing.

23. Locate and drill the two holes for mounting.

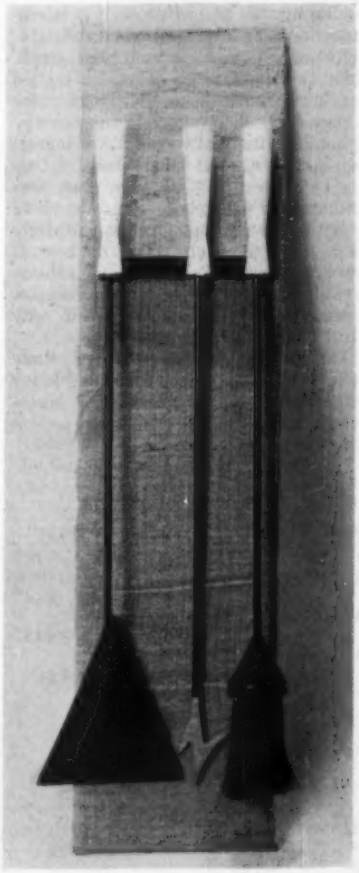
24. Remove all burrs with a file.

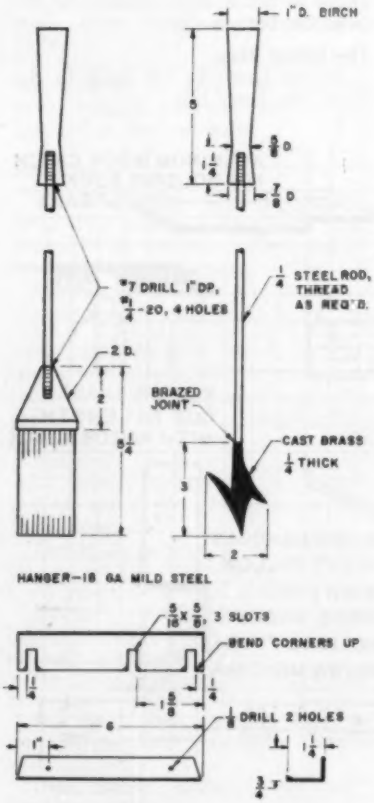
25. Prepare the handles for finishing by cleaning with 180-grit abrasive paper. Apply lacquer undercoat; allow to dry and sand lightly with 180-grit paper. Apply two coats flat white lacquer.

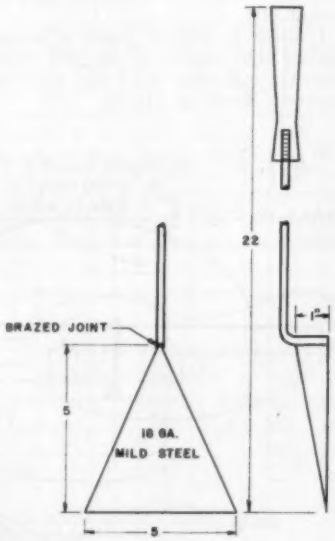
26. Prepare the poker, shovel, brush, and hanger for finishing. Clean with fine abrasive, steel wool, and solvent as necessary.

27. Apply primer and two coats of flat black lacquer to the above pieces.

28. Assemble the handles and fireplace tools. □







BOOK ENDS IN ACTION

HENRY P. KEMP

Instructor in Drafting and Carpentry
Prairie View A and M College, Prairie View, Tex.

Here is a new slant to an old angle. Due to the number and variety of curves making up this unique project, it is recommended for advanced woodwork students only. As you see from photograph, these two replicas of muscular bodied serfs make a handsome picture of grace as they exert every ounce of their energy in holding the books erect. The several man-hours required in obtaining a top-quality project will be completely forgotten when you finally glance at these colorful creations performing faithfully their respective jobs. The book ends are identical in construction; therefore all directions refer to the processes necessary for the completion of only one.

The project is composed of three parts — the man, upper base, and lower base. The simplest construction procedure is as follows:

1. Cut out all parts.
2. Complete all tool work and sanding of all parts.
3. Assemble complete project.
4. Dismantle the project and apply all finishing materials (paint, stain, shellac, sawdust, wax).
5. Make final assembly.

Before any construction can take place, it will be necessary to make patterns. Use any medium weight cardboard for this purpose. Be sure to use one-half in. square blocks in producing the full-size patterns.

The Serf

Because the man or serf is the most difficult of the three parts, let us start with it first.

1. Using a smooth plane or power sanding belt, remove all machine marks from the mahogany stock and work the thickness down to 1⅛ in.
2. With pattern of serf, lay off two on mahogany stock. Be sure grain runs parallel with outstretched arms, back, and straight leg.
3. Cut out figures on jig saw with blade no wider than ⅛ in. Be sure to cut with a somewhat swift and even motion so that filing and sanding will be at a minimum.
4. Using finger gauge and try square, mark off for head and leg cuts.
5. Clamp figure in vise when working on head and legs. Use backsaw and sharp chisels to remove excess stock. *Be extra careful in this process for there is danger of the forward leg breaking at its narrowest point.*
6. Using file and 2/0 sandpaper, smooth the entire figure. Round all edges except those at the ends of the legs. *Do an extra special job from the waist up.*

The Upper Base

The serf performs his duties while standing directly on the upper base. Its construction is as follows:

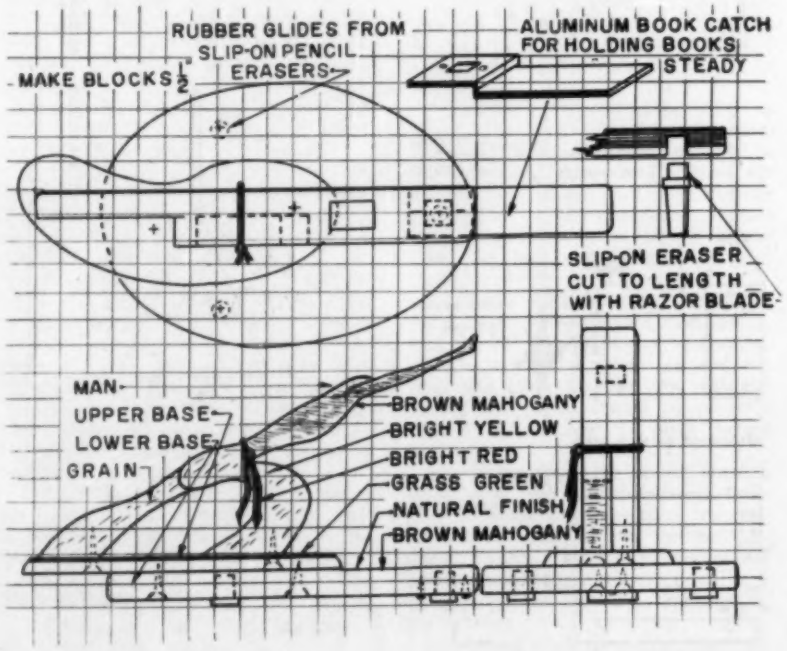
1. Using the pattern, trace this upper base on the ¼ in. plywood. Make sure the grain runs parallel to the centerline of the serf.
2. With the same blade in the jig-saw, cut out with a swift, even motion.
3. Using a file and 2/0 sandpaper, remove all saw marks from the edges and round the top edge gracefully completely around.
4. Sand the top surface with 4/0 sandpaper.
5. Drill two ⅛ in. holes in proper places to fasten serf. Countersink each from the bottom side.

The Lower Base

At this point, we are ready to construct the lower base.

Bill of Materials

Quan.	*Descrip.*	*Material*	*Size*
1	Serf	Mahogany	1¼ x 4½ x 18"
1	Upper base	Fir plywood	¼ x 3 x 14"
1	Lower base	Birch plywood	½ x 5¼ x 15"
1		Sheet aluminum	26 or 28 ga.
6		Slip-on pencil erasers	
1	8-oz. bottle of glue (white glue in squeeze bottle)		
1 qt. fine sawdust (type found around sanding machines)			
Screws:			
4	1" No. 6 F.H.		
4	⅝" No. 6 F.H.		
4	¼" No. 2 R.H.		
Sandpaper:			
2 sheets No. 2/0			
2 sheets No. 4/0			
2 sheets No. 6/0			
1 pt. white shellac			
½ pt. brown mahogany stain			
½ pt. bright yellow enamel			
½ pt. dark green enamel			
1 pad 4/0 steel wool			
paste wax			
24" bright red embroidery thread			



1. With the grain running parallel to the center line, lay off the base.

2. Cut out smoothly on the jig saw and sand edges with a disk sander or by hand. Round off gently both the top and bottom edges completely around.

3. Turn base with face side down; mark centers for rubber slip-on pencil erasers. Select bit with diameter same as eraser and bore on drill press.

4. Mark centers for screws holding upper base. Using a 1/8 in. drill bore completely through and countersink on bottom side.

5. Using single edge razor blade cut off both ends of the erasers until they fit. The large ends which the book ends rest on should protrude 1/4 in. from the base.

6. Make book-catch from 26 or 28 ga. sheet aluminum and cut square opening in end which fits over front glide. Secure in place with two round head screws, 1/4 in. long. Sand edges of aluminum to keep from scratching surface resting on.

The Assembly Process

At this stage of the project, we should have all parts cut, sanded, drilled, and the aluminum book catch fastened in place. Now we assemble the complete project.

1. Fasten serf to the base in the proper position. Be sure to bore lead holes in each leg to eliminate splitting.

2. In this position, use 6/0 sandpaper and make a final sanding on the serf's upper body.

3. Install the rubber glides in their proper positions, making sure they protrude from the base approximately 1/4 in.

4. Secure serf on upper base, to lower base with 5/8 in. screws. Be sure ends of serf's hands and front edge of lower base are in line vertically.

Finishing

You now see the unique picture made by the two working serfs. At this point, dismantle the complete project and begin the finishing processes.

In order to add life and realism to the project, a smooth layer of fine sawdust is glued to the serf's legs to represent his trousers. The entire upper base is also covered with this same material to indicate a grassed area. This process may be best accomplished by squeezing glue on the surfaces and spreading it evenly with a large, wet artist brush. Sprinkle in the sawdust and set out to dry. Be generous with the sawdust.

The finish coloring is an individual choice, but the following combinations really make a beautiful picture:

The serf — brown mahogany for upper body, bright yellow trousers, bright red sash (embroidery thread).

The upper base — grass green or dark green enamel.

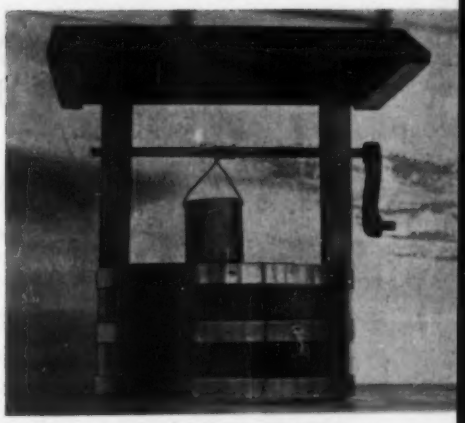
The lower base — natural finish on top surface, dark mahogany around edges.

Then shellac, steelwool, and wax· gentlemen, that's it. □

WISHING WELL PLANTER

ELMER B. MATTSON

Metals Instructor
San Carlos, Calif., High School



An attractive wishing well planter can be made from the various pieces of scrap lumber found in every shop. All types of scraps may be used. Whether hard or soft woods, the results can be interesting. The planter shown was made of California redwood, but one can combine various woods.

A one pound coffee can is needed for the basic well, and around this can the segments are glued. The segments are cut on a table saw in the following order:

1. Bring saw fence 15/16 in. from saw blade.
2. Set saw arbor at 8°.
3. Run lumber through.
4. Then run opposite end through to obtain angle.
5. Remember to make one cut and then reverse ends before making next cut; if this is not done, a parallel piece of lumber is cut.

From this stock, cut 22 pieces 3½ in. long, and 2 pieces 9 in. long. Drill ¼ in. hole on 9 in. pieces, 2¾ in. down from one end to receive ¼ in. dowel.

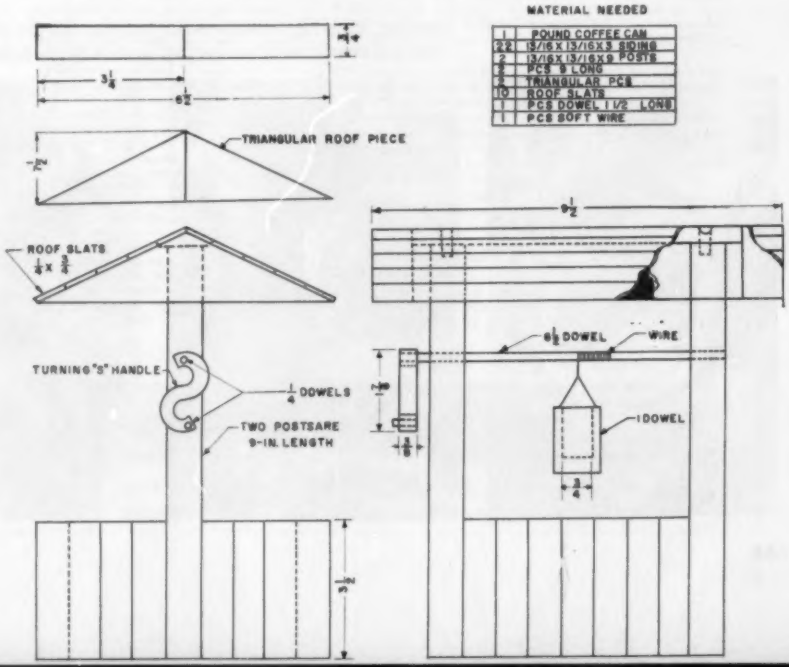
Start assembling, using wood glue liberally to all three sides of stock. Use strong rubber band around can, and proceed to place segments in place between the can and the rubber band. Place ¼ in. dowel in place between two 9 in. posts and glue in proper place. Let dry, wiping excess glue with damp cloth.

Roof support is composed of two triangular end pieces, 6½ in. long, with an altitude of 1½ in. The roof is ¼ in. slats, or miniature shingles can be made. Once roof assembly is completed, several ways of attaching it to 9 in. posts is available to the student. Glue a piece of ¼ in. roof slat material to the ridge line of the roof on the underneath side. Because of the ridge line, an angle is formed and by gluing the ¼ in. slat to the underneath side, the roof will now set square with the planter.

One of the easiest ways to attach the roof to the posts would be merely to use finishing nails — plus glue — and nailing roof into position as indicated by the photo. Another way in attaching the roof to the two posts would be to use ¼ in. dowels as indicated in the drawing, doweling post to the ¼ in. slat underneath the ridge line of the roof.

The bucket is 1 in. dowel and hollowed with ¾ in. drill. Attach wire to bucket and onto ¼ in. dowel. The handle may be made in form of an "S," or one made to suit individual student.

Copper band is buffed and added at completion of project to add further beauty. Spray project with lacquer to give professional appearance. □



INTERPRETATION OF INDUSTRY IN THE JUNIOR HIGH SCHOOL

ROBERT B. GREEN, GLENN E. EARL and JAY T. MILLS

Students and Demonstration Teacher (respectively)
Trenton State College, Trenton, N. J.

How to provide the student with experiences in understanding of industry was the problem set before the student teachers assigned to Antheil Junior High School. An effective way of providing such experience is through use of an appealing project which can be produced by mass production methods. The project selected was the cam action nut cracker presented by Leon I. Reissman (see pg. 47 of your IA/VE for October, 1960). We feel that, if time permits, students should make this selection, but since time was at a premium the student teachers did the selecting. We looked for a simple project of three or more pieces, one the students could produce, assemble, and finish in two or three class periods.

Objectives of the Interpretation

The objectives we set up were:

1. To provide the students with a basic knowledge of some techniques for making duplicate parts.

2. To show the student how the mechanical advantage of a lever and the action of the cam is put to a basic practical use.

3. To provide the students with a basic understanding of how co-operative attitudes are an invaluable asset in living with others.

4. To provide the students with an interesting project in which the class as a whole participates.

Procedure

The jigs and operations were explained to the class first, then the more capable students were instructed in the use of jigs on the bandsaw, jigsaw, and drill press. (This was done for safety's sake.) The use of a flow chart was explained. The students were shown the nut cracker model and they set up the flow chart for it. The students broke down the project into its three pieces. We found they could arrive at a flow chart for the project on their own.

The instructor helped them over the rough spots and points which they did not understand or in which they lacked experience. It is surprising how much some junior high students know about mass production. These students who had never produced a project of this type broke down the steps and operations in logical order. We found these students had learned quite a bit about mass production at home. We also found that just prior to our venture the history classes had covered the industrial revolution. This correlation of subject matter was by accident in this case. This would, of course, be the optimum in such a project — to have as much correlation between subjects as possible.

The original design was altered to make it more adaptable to production. Curves of tight radius were eliminated to facilitate faster cutting on the bandsaw and jig saw. Jigs were developed to enable the machine operators to follow these irregular curves with speed, accuracy, and safety. After cutting the stock, the pieces moved to the belt and drum sanders to eliminate the saw marks. They then went to the drill press for drilling. Finally to the final assembly with the students performing all of the operations. We used 1 in. maple with a salad oil finish. The cost per unit was $.255.

Follow-up Comments

The follow-up discussion was an important part of this experience. Some student reactions on the positive side were:

1. "More projects are made in a shorter length of time." The pilot model was made by a student teacher and it took him ½ hour; the class produced 23 in 2 hours.

2. "All the pieces were the same." Interchangeability of parts. Some students listed the disadvantages of mass production:

1. "My nut cracker is the same as all the others." No individuality; some students felt they could have made theirs differently.

2. "There were too many bottlenecks." Lack of certain machines in the shop — an understandable lack of facility in a shop which is not designed to do this type of work.

3. "Jobs got to be boring."

4. "They (meaning the nut crackers) weren't made as well as if I had done the job myself." Pointing out the lack of craftsmanship in mass production.

All the students participated in the project. In order that the students would understand the entire operation they were rotated through all of the operations. By this method the students found out exactly what the others were doing.

After seeing the outcome of the project, we recommend this activity for you and your students. Your students will learn something of industry and enjoy doing it. □

Sawing, sanding, and drilling operations in mass producing an eccentric nutcracker by junior high school students.

READING — INDUSTRIAL ARTS

(Continued from page 25)

necessary directions which the student must understand in order to finish his project successfully. Outlines, according to the manufacturer's directions, are drying time, area of coverage (does he have enough paint to do the job?), preparation of surface to be painted, and safety instruction.

Again, this reading for specific information is handled by the teacher on an individual basis at the time of need; repeated questioning elicits the specific information and the student, in most cases, verifies the information he has read by inspection, measuring, and testing.

Q. The fourth skill, reading to answer a specific question, seems quite broad. How is this applied specifically to industrial arts?

A. This skill involves a combination of the second and third basic reading abilities, I would say. Reading to answer a specific question is concerned with locating the information which requires skimming or speed reading, the use of an index, understanding a table of contents, the importance of footnotes, alphabetizing, etc. Through the use of textbooks and reference material, the I-A instructor reinforces and provides practice in the use of the standard means of locating information. After this first step, the second phase, finding the answer to a specific question, is identical to the third skill of reading for important details.

It is in the first part of this fourth skill that the instructor has specific responsibilities for reading instruction. The reference books used regularly in I-A classes have such an unusual organization that for their correct use students need specific instruction.

Q. What are some examples of these specialized reference materials which require the exercise of this reading skill — accomplished, of course, on an individual basis at the time of need and in answer to a specific question?

A. Well, there is the *Machinery's Handbook*, which is organized in a typical reference manner, and *Chilton's Automobile Repair Manual*, which is an example of the complexity of organization of auto repair manuals. It has the table of contents arranged by topic of the separate car section and not by page number.

However, let's consider *The Radio-Electronic Master*,[3] the official buying guide of the industry. It is an example of a specialized I-A reference book which requires specific instruction in its use. The use of this specialized reference material is an example of one of the extensions of reading skills developed in Industrial Arts. As are many shop reference materials, this buying guide is not organized according to standard reference practices. It can be confusing, therefore, unless specific instruction for its use is given. Instead of an index at the back of the book, it has three separate indices: (1) alphabetical index of manufacturers, (2) general index, and (3) outlines

[3] *The Radio-Electronic Master*, 20th ed. (New York: The United Catalog Publishers, Inc., 1955).

HOW DO YOU COMMUNICATE?

In your teaching, do you help student learn through these experiences? Check those you develop.

___Listening	___Accuracy in reading	___Schematic diagrams
___Graphic and concrete experiences for understanding	___Following directions	___Graphs
___Oral use of new words	___Reasoning	___Figures
___Word recognition	___Use new words in writing	___Charts
___Vocabulary Building	___Fact recall	___Maps
___Comprehension	___Evaluation	___Pictures
___Selecting main points	___Critical analysis	___Cartoons
___Using textbook aids	___Integration of new ideas	___Symbols
___Using supplementary books	___Forming sensory images	___Working drawings
___Alphabetizing	___Making comparisons	
___Using the dictionary	___Organizing ideas	
___Selecting correct definitions	___Making generalizations	
___Adjustment of reading rate to purpose	___Summarizing	
___Enjoyment of reading	___Recreational reading	

If, in your classes, students are learning some of the above,

YOU ARE TEACHING READING!

Above: a check sheet used to prove to teachers that they are teaching reading — albeit not with a drill or formalized approach. Below: part of the label of a paint can with instructions for the product's use, which serves to illustrate how phases of industrial arts work help students learn several of the basic reading skills.

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NEW WOOD — Surface should be clean, dry and free of dirt, wax, oil and grease. Prime with 2 coats of 8209 Flat White Undercoat. Finish with 1 or more coats of Fuller Semi-Gloss Enamel.

PAINTED WOOD that is in good condition is easily finished by thoroughly cleaning and sanding lightly. Then apply 1 or more coats of Fuller Semi-Gloss Enamel. Before refinishing surfaces in poor condition, remove all loose, scaling paint, sand smooth and prime with 8209 Flat White Undercoat.

NEW WALLS should be thoroughly sealed with 4789 Syntoseal. Two coats may be required. Finish with 1 or more coats of Fuller Semi-Gloss Enamel.

PAINTED WALLS may not require sealing. However, if sealing is necessary apply 4789 Syntoseal and finish with Fuller Semi-Gloss Enamel.

FOR CLEAN-UP — Brushes and rollers wash out easily with a generous quantity of most powdered household detergents in warm water. Or, use Painters' Thinner or turpentine.

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index of display pages. These are in the front of the book and occupy the same place as the usual table of contents. The pages are not numbered consecutively, but are organized in sections A–U and numbered within each section.

In using such a reference work, students read to answer a specific question by locating the information and reading for important details. This area of reading instruction is one perhaps, which many instructors have not recognized as a contribution to their students' reading skills. Students certainly are not aware that they are acquiring reading skills.

Q. And the fifth skill, reading to evaluate; how does that gear with I-A instruction?

A. This skill enables the student to differentiate between statements of fact and statements of opinion. They also check the basis of authority for making a statement. The time that a statement was made is important, since it might have been made prior to the discovery of some new data. Students learn to evaluate by comparing statements made by different authorities and then to check these authorities whenever possible by direct experience and research.

Q. And how is this accomplished in industrial arts instruction?

A. This is, perhaps, the least used reading skill in Industrial Arts, but on an advanced level, the student with experience and skill, evaluates design information, construction procedure, etc. The reading of schematic diagrams, working drawings, etc., need to be evaluated particularly those in some of the hobby magazines.

Q. Let's go on to the sixth skill, applying what is read. This would seem to have a direct relation to I-A instruction.

A. Absolutely. It's most important in our field and every instructor should include the teaching of this skill as a regular part of his program while using the three common methods of communication: (1) oral instruction, (2) working drawings which include some writing, and (3) written instructions. The good teacher balances, of course, these three methods of imparting information.

Q. And what are examples of how these methods of instruction are utilized to help students apply what they read?

A. First, in making a job card, a sequential list of operations in building a project, the student, from reading instructions, is required to write the operations in order. (This technique parallels development of reading charts in the elementary school.) This individual effort follows, of course, from the making of a job card as a class project.

Another operation which involves the application of information obtained from reading, is that of planning a "routing bill" for a production job. This involves planning production stations for the step-by-step operations of cutting, fastening, assembling, finishing, packaging, and distributing.

The reading of dimensions, the selection of materials, the use of fasteners, the selection of drills and taps, and the setting of a form: all involve reading followed by application. Of course, simpler examples consist of interpreting such safety signs as "place only rags here," "observe safety lines," "do not use this piece of equipment without the instructor's approval," etc.

I would say the important factor in the application of what is read in industrial arts is that the results of the interpretation of the written material is immediately apparent. It is the responsibility of the I-A instructor to have students use written material as directed, to help students develop abilities in this type of reading, and to challenge the able students with problems in applying what they read to complex situations.

Q. Has the seventh skill, developing a vocabulary, a high degree of application in industrial arts?

A. Instructors with industrial arts training have made, I would judge, more progress in the development of vocabulary than any of the other basic reading abilities.

Although there has been some recent literature published concerning the vocabulary needs for the different activities by grade level — as well as lists appearing in study guides — there is a need for basic research in the vocabulary of industrial arts subjects. The principal areas which seem to need investigation are: (1) the level of vocabulary of secondary school textbooks; (2) basic vocabulary lists developed by activities and grade levels in oral and reading and writing functions; and (3) the words which have industrial arts meanings differing from their common usage, for example, "tolerance."

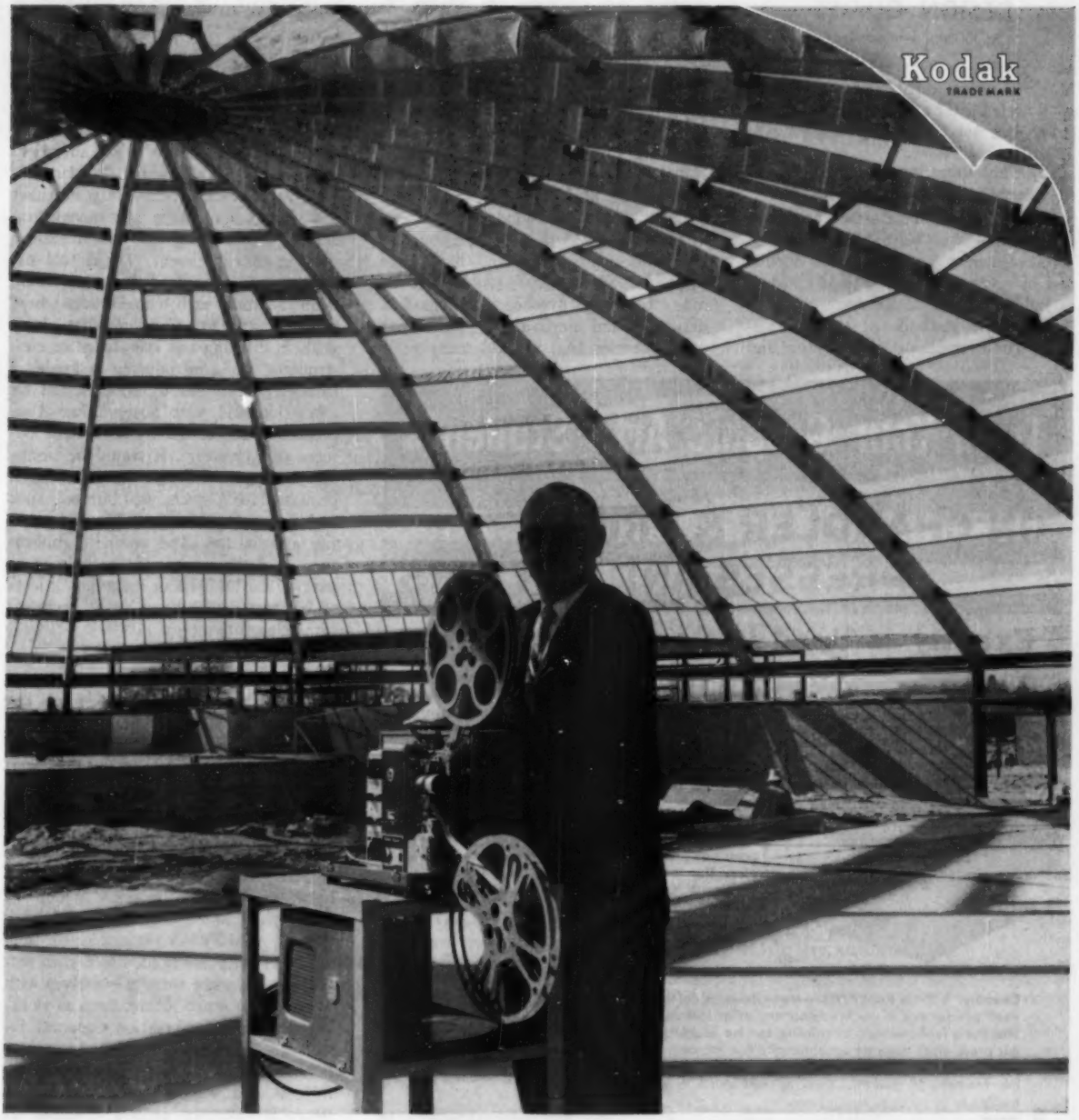
But, to go on, instructors promote the development of vocabulary by labeling, by the use or completion quizzes, by captions on bulletin boards and other displays. Instructors must realize that it is not enough for them to say a word. In order for students to learn new words, they must hear it, see it, use it, and review it.

Q. And the eighth reading skill?

A. Before we go on to that, I would like to interject a few devices which the instructor must use to further the seventh skill. One commonly used practice is to have students develop a vocabulary list in a notebook. Another is to have a "word-of-the-week" sign in which the letters can be changed to follow a schedule to highlight important words. By including this series of words in shop demonstration and in "quickie" quizzes, the teacher helps underline the importance to students of adding technical words to their vocabulary.

The elementary school technique

(Continued on page 50)



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DESIGN GUIDES

(Concluded from page 31)

not capable or bent in this direction. Many of us are capable of appreciating good design after exposure and intensive study, but not capable of producing it.

3. Student Experience
4. Designing Mechanics

The points which we stated originally as 3 and 4 will be discussed jointly. Those teachers who have been identified by some as being the best teachers in industrial arts design have shown a few possible methods of teaching design. These methods of teaching and drawing out students are studies in themselves which will no doubt take years to perfect. It seems that we often suppose that the only way to initiate new concepts in the educational field is to instill in undergraduate students in teacher training programs the importance of a theoretically good concept and then hope for the best. Due to this thinking we have often gone off "half cocked," and later found out that our original idea was a good one, but we went too far too fast and have gone overboard. It is very possible that we may likewise go overboard in regard to designing and find, as we have with other theories, that it takes many years to recuperate (the time for recuperation of the various schools being proportionate to the number of students infected with the mistake).

The first steps in teaching design must come gradually and be presented by teachers who, in view of their experience and effectiveness, can afford to experiment without ruining the curriculum that they have presently in effect and that these teachers must have a firm understanding of good design before starting to experiment. The actual experimenting in original designing would be in the upper high school grades where students are armed, somewhat, with skills in drafting and knowledge of construction, while introducing in grades 7 through 10 studies of good design by discussion and vast observation. Also, preceding the design of decorative objects and furniture, it would be necessary to work on design of objects used primarily for a mechanical purpose, such as parts of machines, simple tools, and jigs and fixtures. The aesthetic application to designing would come later as part of the problem in designing objects to be used in the home or as architectural elements.

5. Usefulness of Training

Finally, point 5 was "How much designing will students find themselves doing after leaving school?" Socrates said "Wealth is useless to the man who does not know how to use it." I don't think that Socrates mentioned it in this sense but leisure time is surely a wealth and it is certainly useless when not used correctly. In this context designing can be of great wealth to many in our society who choose to use their leisure time in creative designing. Leisure time has been very closely identified with recreation, but when we find ourselves with over half as much leisure time as working time, mere recreation becomes insufficient. Recreation as an escape or diversion from our work becomes meaningless as a way of using our leisure time. It becomes serious business. It becomes a plateau in our civilization where the whole of our society has the opportunity to develop and extend the fulfillment of the human life, and the understanding and appreciation of the joy of living.

In our laboratories we have great opportunity to help other human beings to help themselves live deeper and nearer to the truth of things. One of the ways to come closer to the truth is by handing some of yourself to an idea outside yourself, whether it be the creation of a practical object, a work of art or a cause for the betterment of other living things. Inevitably our shops will become more mechanized, packed with machines and instruments which will bewilder us all except in our own field. □

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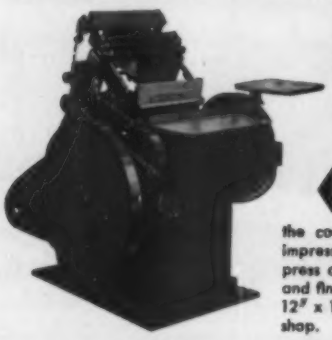

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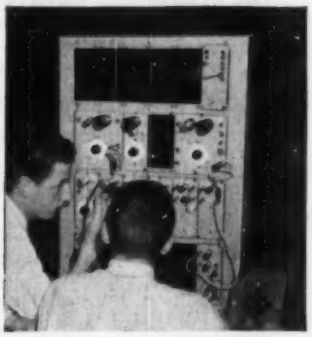

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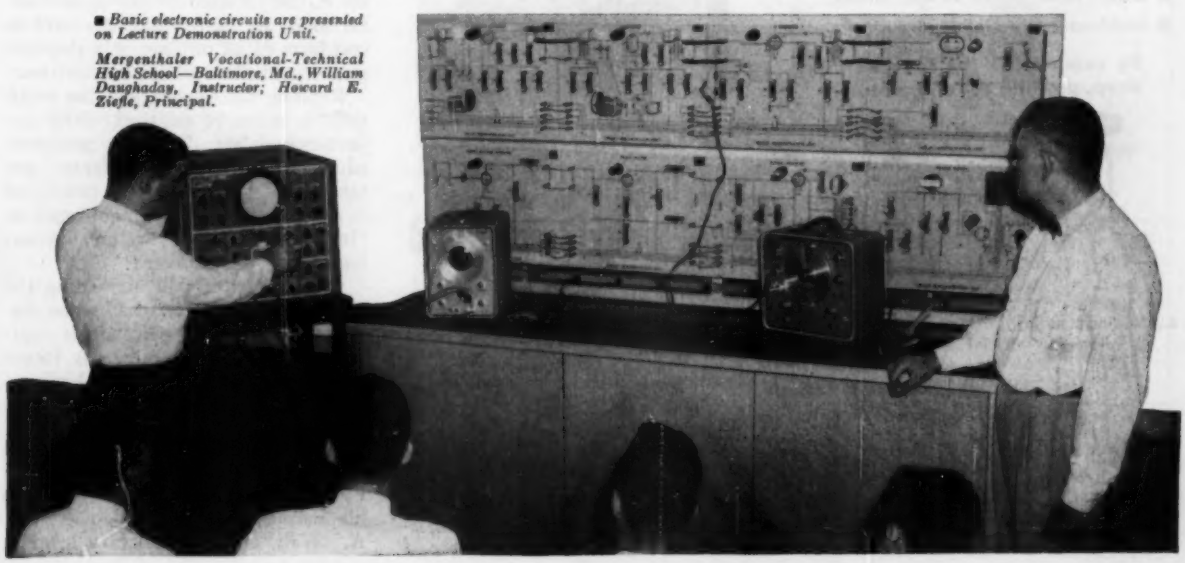

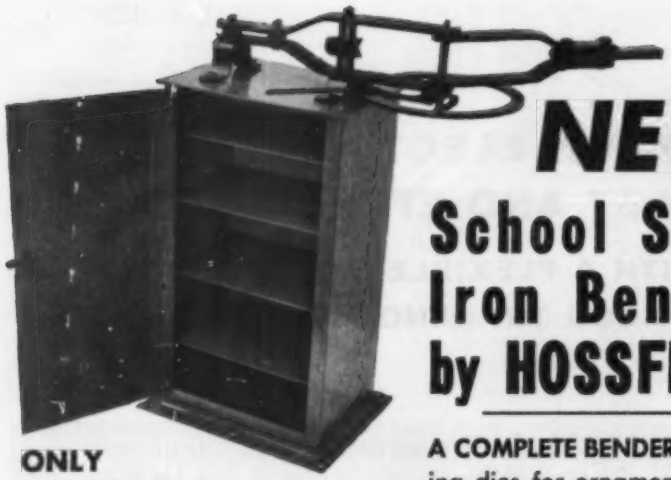

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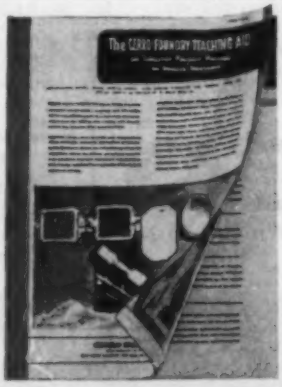

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READING — INDUSTRIAL ARTS

(Continued from page 46)

of using flash cards is highly adaptable here. Many teachers are using flip charts for instructional purposes with carefully prepared and labeled illustrative material; this labeling makes it easy for the teacher to coordinate oral and visual stimuli so necessary for vocabulary building.

In addition, I'm eager to learn the results of using a dictionary box. This has a series of 5 by 8 cards with an important word printed in the upper left-hand corner of each card. Immediately under this is the word divided by syllables with the accent for pronunciation. Pictures and sentences illustrate the word. On the reverse side of the card will be a definition of the word. This dictionary box is essential when used by students writing job cards, bills of material, and other written reports; by amplifying dictionary information, it extends learning and increases student independence.

Q. And how does the eighth skill, outlining and summarizing what is read, apply to industrial arts?

A. Let's consider the last three skills together: the eighth; the ninth, reading for implications; and the tenth, increasing the reading rate.

Outlining and summarizing what is read facilitates organizing of important and valid information according to a purpose in mind — a study technique, according to research, which helps the learner retain more information than merely reading and rereading assigned material. This skill does have limited application in industrial arts. When we discussed the use of the job card for the sixth reading skill, we noted that this card is one form of an outline, or a step-by-step organization of doing activities.

Reading for implication, the ninth skill, is again, of relatively little importance in our field. In consumer education, though, students are taught to question material published in advertisements. Statements such as "brass finished" and "walnut finished hardwood" are analyzed.

And the tenth skill, increasing the reading rate, is approached when students are taught to adjust their reading rate from skimming to locate needed material to reading slowly to find important details.

Q. What would you say, then, that the Industrial Arts teacher might do by way of furthering reading skills in his instruction?

A. Well, on the secondary level in

the Los Angeles City Schools, students are encouraged to do free reading in I-A classes. Each shop has a small library — approximately 50 books, plus magazines which apply to the area of instruction. Several magazines are supplied in classroom sets. Research has shown that there is a high interest factor, I might add, in mechanical and technical magazines and students are taught to read these for enjoyment. Above all, I-A teachers need to be aware of their role and responsibilities in reading instruction.

Q. Finally, Mr. Funk, would you care to suggest what might be done on different levels by way of accelerating the role of industrial arts in teaching reading?

A. Teacher training programs must include at least a survey course in principles and purposes of the reading program. School districts should establish in-service training programs to enlighten industrial arts instructors about their responsibilities.

The importance of the role of industrial arts in the development of basic reading abilities is clearly evident. It must be apparent also that there are specialized reading skills peculiar to industrial arts. Our instructors should be alerted to the contribution to, and responsibility for developing this basic skill. An analysis of the more successful teachers' techniques reveals many areas where reading instruction is taking place — and it is taking place without the teacher designating the instruction as reading, in his own thought or in that of the students.

The most significant contribution that the discipline of industrial arts can make to reading is in the area of development of meaning! In the industrial society in which we live we need to understand the language of industry. In order to be an educated man in this civilization, one must have an understanding of the world of industry. Basic to this understanding is reading. And basic to all reading is meaning! □

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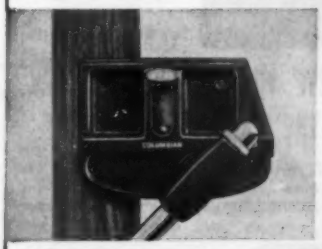

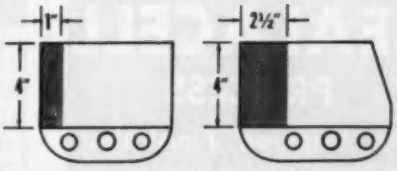

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INDUSTRIAL ARTS ASSOCIATION OF PENNSYLVANIA

The Ninth Annual Convention of the Industrial Arts Association of Pennsylvania will be held at Hershey on October 20 and 21. The convention theme will be "Individuals, Automation, and Space Exploration — Challenges and Implications for Industrial Arts."

Officers are: Elmer J. Hemberger, president; Dr. Wade Wilson, vice-president; Joseph Kennedy, treasurer; and William C. Bohn, secretary.

24TH ANNUAL CONVENTION NEW ENGLAND INDUSTRIAL ARTS TEACHERS ASSOCIATION

The New England Industrial Arts Teachers Association will hold its 24th Annual Convention on October 13 and 14, 1961 in historic Newport, R. I.

The Hotel Viking has been chosen as convention quarters. All activities, excepting trips and tours, will be centered at the hotel.

Edmund Medeiros of Peck Junior High School, Berrington, R. I., has been designated general chairman for the convention; and Robert W. Proulx of Riverside, R. I., High School, Riverside, the exhibits chairman.

Acting upon the request of the membership, convention planning is providing longer visitation periods at the exhibitors' booths.

COMING CONVENTIONS

Oct. 6–7. Four State Industrial Arts Conference, at Kansas State College Campus, Pittsburg. Exhibit chairman: Forest L. Penny, Industrial Education Department, Kansas State College, Pittsburg, Kans.

Oct. 13–14. New England Industrial Arts Teachers Association, at Hotel Viking, Newport, R. I. Secretary: Edward P. Stach, Warren Harding High School, Bridgeport 10, Conn.

Oct. 19. North Dakota Industrial Education Association, at Minot, No. Dak. President, Ronald Burt, South Junior High School, Grand Forks, No. Dak.

Oct. 19–20. Minnesota Vocational Association, at Nicollet Hotel, Minneapolis, Minn. Exhibit chairman: Louis Derby, 4th Ave. & Grant St., Minneapolis 4, Minn.

Oct 20–21. Industrial Arts Association of Pennsylvania, at Hershey, Pa. Secretary: William C. Bohn, 9 Hindman Ave., Burgettstown, Pa.

Oct. 27–28. Oklahoma Industrial Arts Association, at Oklahoma City, Okla. Exhibit chairman: George Dusbabek, 23rd and Blackwelder, Oklahoma City, Okla.

Nov. 3–4. Kentucky Industrial Education Association, at Kentucky Hotel, Louisville, Ky. Exhibit chairman: Paul E. Harris. 506 W. Hill St., Louisville, Ky.

Nov. 10–11. Oregon Industrial Arts Association, at High School, Medford, Ore. Exhibit chairman: Vern Voss, High School, Medford, Ore.

Dec. 3–8. American Technical Education Association, at Hotel Muehleback, Kansas City, Mo. Secretary: William N. Fenninger, 22 Oakwood Place, Delmar, N. Y.

Dec. 4–8. American Vocational Association, Inc., at Municipal Auditorium, Kansas City, Mo. Exhibit chairman: Lowell Burkett, 1010 Vermont St., N.W., Washington 5, D. C.

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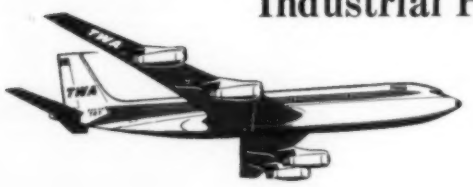

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appointments . . .

☐ *Fred Olsen,* now assistant professor of industrial arts at Western Washington State College, Bellingham. He was formerly an instructor in industrial arts at Ohio State University.

☐ *Gerald Bailey,* former teacher of industrial arts at Ellensburg, Wash., is acting instructor of industrial arts at Western Washington State College, Bellingham, in the absence of John Hauser.

☐ *Dr. Charles Risher,* assistant professor of industrial arts at Western Michigan University, Kalamazoo, was guest professor at Western Washington State College, Bellingham, Wash., teaching power mechanics and professional courses during the summer session.

☐ *Edward L. Katzenback, Jr.,* of Trenton, N. J., has been named a Deputy Assistant Secretary of Defense in the Office of the Assistant Secretary of Defense (Manpower). He will be Deputy Assistant for Education and Manpower Resources, a new position with responsibility for the policy direction and coordination of Armed Forces education and information programs, relationships between the Department of Defense and civilian educators, and for the manpower resources aspects of policies and programs involving scientific, professional, technical, and other critical skills.

☐ *Dr. William P. Spence* has been appointed director of the industrial education and art department, Kansas State Teachers College at Pittsburg. He was formerly an associate professor of industrial education at Western Michigan University, Kalamazoo. (Dr. Spence writes the "research" column which appears in IA/VE.)

awards . . .

☐ *Rex Miller,* associate professor of industrial arts education, State University of New York College of Education at Buffalo, N. Y., received the doctor of education degree at the University of Buffalo, on June 11, 1961. His dissertation was entitled "An Examination of the Objectives of Industrial Arts Education with Respect to Certain Selected Sociological Factors of Contemporary American Society."

Dr. Miller has been teaching electronics and electricity classes at the College of Education, Buffalo, for the past four years and previously was a teacher in the public schools of Iowa. He obtained his Bachelor of Arts degree from Iowa State Teachers College and his Master of Arts degree from Colorado State College.

☐ *Otto C. Olsen,* former head of the vocational arts division at Nebraska State Teachers College at Kearney, was honored at the College's Alumni Day in June.

Events of the day long activities were planned around the dedication of the $770,000 vocational arts building to his name. College President Herbert L. Cushing told those in attendance that henceforth the building would be known as the Otto C. Olsen Vocational Arts Building.

Mr. Olsen earned his two year degree in 1919 from Kearney Normal School (now Nebraska State). He received his B.S. degree from Stout Institute (now Stout State College, Menomonie, Wis.) in 1921, and his Masters degree from the University of Missouri in 1935. His retirement from the staff at Nebraska State took place in 1958.

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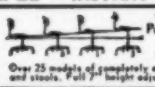
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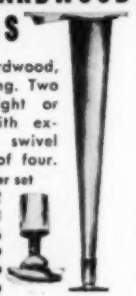
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NEWS

(Concluded from page 7)

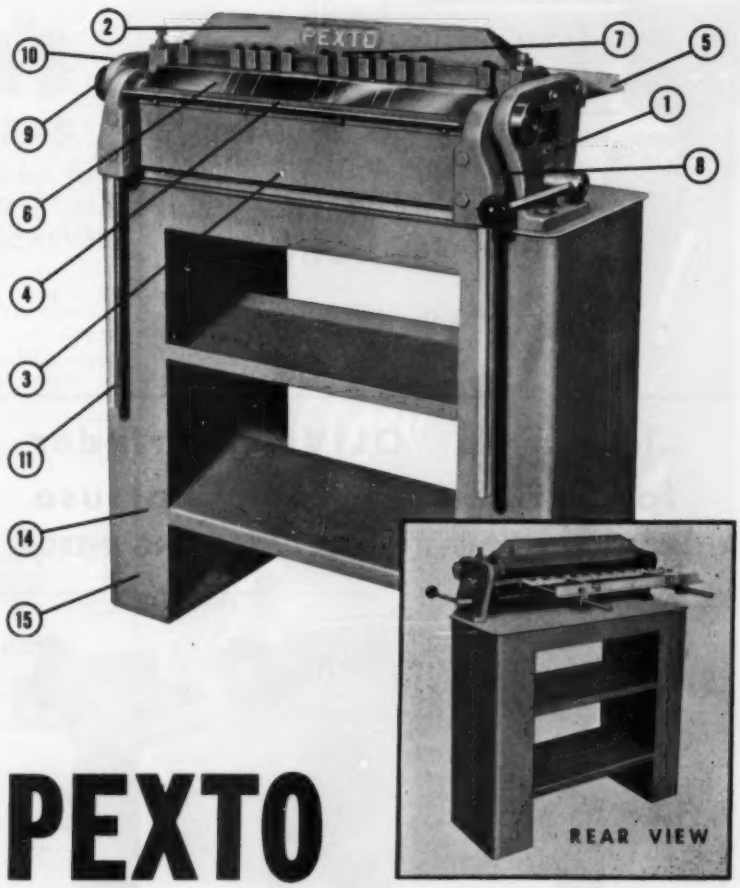
School on October 21. The program will include sessions on what's new in welding, welding and brazing aluminum, what to look for in buying electric welding equipment, braze welding and fusion welding of cast iron, the brazing of aluminum, metal spraying, etc. For additional information, contact Norman R. Braton, assistant professor of welding, College of Engineering, University of Wisconsin, Madison 6. □

On Saturday, October 28, the Industrial Arts Department of Montclair State College in Upper Montclair, N. J.,will hold a conference on "Industrial Arts and Contemporary Society." The tentative program includes an "industrial film festival" — with exhibits from 21 participating companies and organizations. A luncheon and panels on (1) new curriculum directions and (2) automation and the new technology are included in the program. □

A study to develop a series of aims and supporting principles which could be used to indicate direction for development and improvement of **programs of undergraduate industrial education teachers in higher education institutions** in the United States was recently completed by Dr. Carl A. Moeller in his doctoral dissertation at Wayne State University. The study was made under the direction of G. Harold Silvius, professor and chairman of industrial education at the school.

Conclusions of the study included: (1) the need for well-defined competency levels, such as the commonly held concept of journeyman status for trade occupations, for the several

broad areas serviced by teachers of trade or technical subjects; (2) apprenticeship experience is not necessary for the theoretical or "related instruction" phases for teaching a trade occupation, but it is essential for teaching the manipulative phases; (3) in addition to basic orientation, teachers of industrial arts should develop a depth competence in one or two of the I-A areas; (4) an understanding of the social aspects, as well as the technical processes of industry, is essential; and (5) all industrial educators must be thoroughly competent in all phases of the professional aspects of teaching. □



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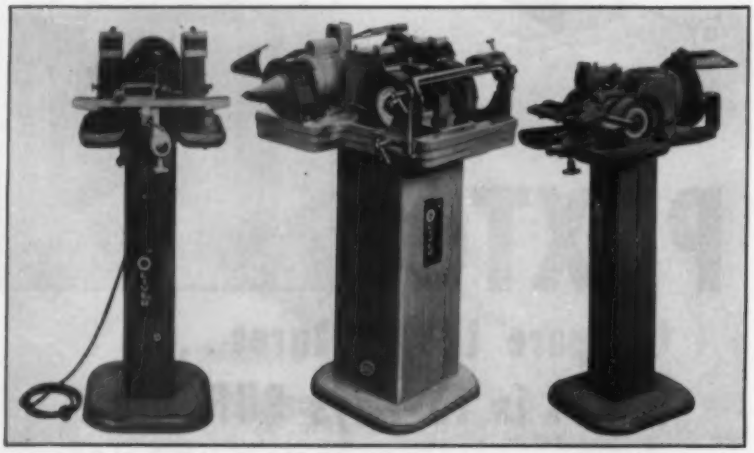

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While there are many welding processes today, we will discuss a comparatively new process of welding — the Eutectic "Low Heat Input" welding process.

At the beginning of the 20th century, J. P. H. Wasserman, a Swiss metallurgist, was instrumental in the development of a new metal-joining process. He observed the phenomenon of surface alloying during brazing operations and this phenomena led to the discovery of the "low heat input" metal joining process which is known today as Eutectic. Later research, development, and perfection of the process were carried on by the son Rene D. Wasserman, who founded the Eutectic Alloys Corporation in New York in 1940. The low temp welding alloys of this process help to minimize the distortion and warping which occurs when other welding processes are used.

Eutectic's exclusive metal-joining process combines the advantages of the Low Heat Input of brazing with the greater strength and homogeneous joints obtained by fusion welding of the parent metal. Actually, the weld forms an alloy of the dissolved filler material on the heated surface. Using Eutectic's Low Heat Input process, the base metal is not brought to fusion temperature. In other words, less heat is needed by this process when compared with other welding processes.

When Eutectic "Low Temperature Welding Alloys" are used, an affinity is created from formation of a surface alloy between the basic metal and the filler metal. This surface alloy is the result of diffusion of the atoms of the basic metal into the liquid Eutectic "Low Temperature Welding Alloy" or filler metal.

It is, therefore, of prime importance to avoid overheating the basic metal when using the Eutectic products. The term bonding temperature will help insure this. Briefly, it is the minimum temperature to which the basic metal should be surface heated to obtain a hold or bond with the filler metal. This bonding temperature is controlled by the filler metal used, the basic metal and the type of joint.

Tension and changes in the metallurgical structure of the basic metal as well as distortion and warping are reduced to a minimum or may be avoided to a great degree. As a result, much less filler metal is needed and much time is saved. These are just a few of the important savings — industrially speaking — which this metal joining process can effect. It can, therefore, be concluded that the Eutectic process is a battle against Fahrenheit.

A few examples can best illustrate Eutectics "Surface Alloying" principle:

It is a known fact that cast iron melts at about 2300° F. The metal must be heated to this degree in order to effect

(Concluded on page 58)

Mr. Andrews is a general shop instructor, Bayside High School, New York City.

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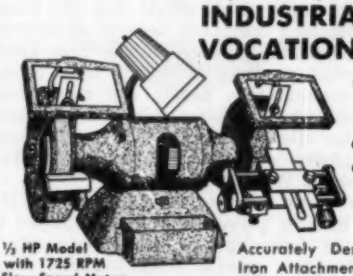

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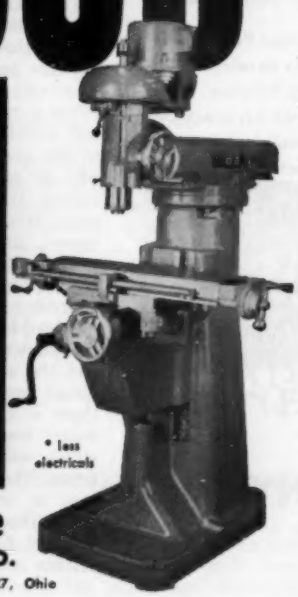

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EUTECTIC WELDING

(Concluded from page 56)

a fusion welding. With Eutectic it can be joined at 1300 to 1600° F. In actuality the cast iron at the surface is changed to steel; carbon is taken out and the joint is completed with a saving of up to 1000° F. This is made possible by the diffusion of the atoms of the base metal into the filler metal.

Salt melts at 1400° F. If a solvent is used this can be reduced to 33° F. Water heated to this temperature will dissolve the salt.

Copper which melts at 1981° F. can be melted at 1350° F. if a solvent is used in connection with heat. Solid copper will melt if placed in a molten copper-phosphorus alloy which is maintained at 1350° F.; a saving of 631° F. is effected below the F. melting point.

This is the principle of Low Heat Input metal joining through surface alloying. The base metal is not melted. It is dissolved by, and surface alloys with, the low melting point molten filler metal. Intensive research has been undertaken by Eutectic to develop a series of alloys with low melting points. High purity metals produced by the most modern refining and alloying techniques have further enhanced the flow and wetting properties of these new brazing type materials.

Thus the economy of Eutectic can readily be seen. The advantages are metallurgical also. Lower consumption of gas, oxygen, and electricity is evident. The time element is also greatly reduced because of the higher fluidity of the alloys. Technically speaking, long lap joints or large square butt joints are completed with alacrity. Chamfering of joints is lessened and, consequently, less material is used. Machining is comparatively simple and very often finishing operations become nil or even eliminated because of the neat clean weld produced. Freedom from messy clean-up time results and most often these highly skilled welders are released for other processes because of the simpleness of the application of the Eutectic Welding Process.

From the instructional standpoint, the Eutectic process might be employed in the following industrial education courses: general shop, machine shop, metal shop, automotive shop, agricultural shop, foundry shop, aircraft shop, refrigeration shop, etc. One may find these subjects taught in academic, comprehensive, technical, and in a few instances specialized high schools for a specific trade.

The metal, automotive, and machine shops would lend themselves more to this process. In the field of jewelry, this process would find great value in the brooches, rings, earrings, cuff links, bracelets, and chain projects. In an agricultural course, farm machinery repair might be learned by the student. Such repairs to tractors, mowers, cultivators, disk and plow type, combines, pumps, and generators are a few of the projects which could be of value. In the foundry shop salvaging of castings, iron, steel, aluminum, magnesium, brass, bronze, and copper; in the automotive shop body work fabrication and repair, salvaging truck and automotive castings, repairs to functional and mechanical parts and salvaging ornaments and accessories are some of the uses to which students could put the Eutectic process of welding.

The introduction of this new process in the school shops would prove beneficial to the student who would learn a low-cost process of welding. Many students who go to technical colleges might follow a career in the engineering, chemical, metallurgical, and industrial aspects of this comparatively new field. Others who do not go to college but seek advanced training in the mechanic arts could bring to industry a saving in time, money, and materials.

Very important factors in the Eutectic process lie in the field of safety. It may be concluded that the process will lead to greater health protection for the welder in industry, the school shop, and the school in general. Eutectic requires less heat with the result that there is a lesser degree of exposure to fumes, less danger of burns and less eye strain with a consequent fewer accidents. The last of these is most important in the management of a school shop. The process lessens the chance of accident to the newly initiated to the science and art of welding. □

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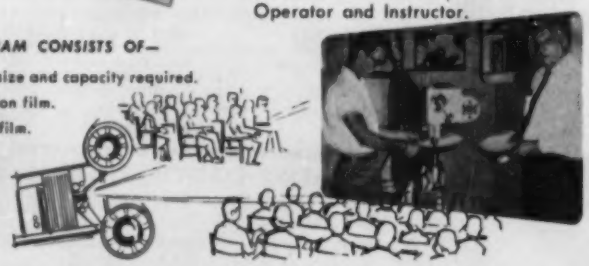

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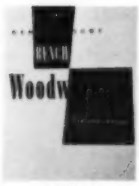

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By O. A. Ludwig 102

A complete textbook for general metalwork — hand and machine. Describes tools, materials and operations common to many metalworking occupations. This book has been described by many authorities as "the most complete book on metalwork ever published." List Price $5.00

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This revised 1960 edition presents the fundamentals of each drafting principle in two easy-to-use parts: (1) operations (manipulative) and (2) information topics (the things to be known). There are 299 illustrations. Problems are presented with each unit. List Price $3.40

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This is a basic manual for beginners in photo-offset lithography. It is a practical guide for the worker, student, teacher, apprentice, salesman, buyer and others wanting a working knowledge of offset printing. List price $4.80.

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Design For You

By Ethel Jane Beitler and Bill Lockhart. Cloth, 206 pp., 8½ by 9 ¼ in., illus. John Wiley & Sons, Inc., New York, N. Y.

Intended as a text for an introductory course in design, this book defines design, discusses the elements within it, and indicates its purpose from functional and aesthetic points of view. It considers the many ways in which it is possible to study, see, produce, or appreciate organization of lines, shapes, spaces, colors, and textures as they are capable of being used in our present-day living — to provide a working knowledge of how to create and evaluate design. Written for "students in the department of applied arts" on the college level, this work is truly profusely illustrated and the examples seem to bring out the abstract ideas of design quite concretely. It makes a definite contribution to the design knowledge of the industrial arts teacher-student.

How to Choose and Use Power Tools

By R. J. DeCristoforo. Cloth, 144 pp., 6½ by 9¼ in., illus., $2.50. Arco Publishing Co., Inc., New York 17, N. Y.

While intended for the home workshop, do-it-yourself specialist, this easily readable and well-illustrated reference on common power tools has a wealth of supplementary material for the woodworking shop. His chapters on such stationary tools as the table saw, the jointer, the drill press, etc. (11 in all), and such portable tools as the cutoff saw, the electric drill, etc. (5 in all). Of value is the graphical and checklist material which accompanies most chapters; the one on the drill press includes sketches for mortising, jigs for duplicate drilling, and routing irregular shapes, a screw hole chart, a listing for good drill-press speeds for different operations on different materials, etc.

Principles of Woodworking

By William F. Holtrop and Herman Hjorth. Cloth, 600 pp., 6¼ by 9¼ in., illus., $5.40. The Bruce Publishing Co., 400 N. Broadway, Milwaukee 1, Wis.

This 1961 edition of the Hjorth classic includes new chapters on modern coated abrasives and on project selection, design, and planning. The chapter on machine tools features the new multi-purpose machines; the chapter on gluing and clamping discusses in detail the new synthetic glues; the chapter on upholstery introduces the new and versatile material, foam rubber: these are among the instances where the chapters have been made more complete with information on new machinery and material.

Make-It-Yourself Toy Book

By Robert Reeves. Cloth, 110 pp., 5½ by 8½ in., illus., $2.95. Charles T. Branford Co., Publishers, Newton Centre 59, Mass.

Some 50 toys with appeal for children are described and illustrated here. The designs are simpler and require only basic tools, common operations, and inexpensive materials — mostly wood, tin, etc. For the elementary and junior general shop.

How to Make Athletic Equipment

By Joel W. Carter. Cloth, 390 pp., 6¼ by 9¼ in., illus., $6.75. The Ronald Press Co., New York 10, N. Y.

This book, prepared by a superintendent of parks and recreation in an Illinois suburban community, provides instruction in the making of practically every item of equipment, from baseball backstops to park furniture and bleacher seating, ending with complete plans for making a whirlpool athletic bath. Most of the items are constructed of wood or cold metal.

Construction and Maintenance for Farm and Home

By Edward W. Foss. Cloth, 373 pp., 6 by 9¼ in., illus., $6.95. John Wiley & Sons, New York, N. Y.

This book presents in some detail the necessary information which a pupil should have before and during the period he engages in each shop activity. In each chapter the necessary materials, tools, and equipment are discussed in a manner to give the student a general understanding of their use. The book does not contain many actual projects. A few are included to illustrate the methods of using tools and of laying out and assembling projects with many parts.

Home Mechanics

By Carl J. Schaefer and Robert E. Smith. Cloth, 148 pp., 6½ by 9⅓ in., illus., $2.96. The Bruce Publishing Company, 400 N. Broadway, Milwaukee 1, Wis.

A revised edition of a guide for making common repairs for such household facilities as window panes, faucets, drains, wire connections, storms-and-screens, etc. Includes the many aspects of home improvement normally undertaken by the "do-it-yourselfer." This edition has new

(Continued on page 62)

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NEW BOOKS

(Continued from page 61)

material on formica maintenance, electrical appliance repair, etc. Suitable as a reference book for general shop on the junior and senior high level.

Rope Roundup

By Bill Severn. Cloth, 237 pp., 6 by 8½ in., illus., $3.95. David McKay Co., New York, N. Y.

For the general reader, this fascinating history of rope is related in an extremely enjoyable narrative manner. Rope is discussed as, among other things, a tool, a business commodity, and a subject for magicians.

The book proceeds from the start in chronological fashion, tracing the importance of rope in man's life. Included are names and anecdotes of various figures that have been prominent in the rope industry in the past, such as Alfred and Hiram Tubbs.

Interesting facets of the subject are treated; there is substantial discussion, for instance, of the real or fabulous Indian Rope Trick. In the same chapter several practicable tricks are described and explained. There are also sections on knots, lariats, and games.

The book is illustrated throughout.

Slide Rule Simplified

By C. O. Harris. Cloth, 278 pp., 5⅞ by 8½ in., illus., American Technical Society, Chicago, Ill.

The second (1961) edition of the highly simplified and very comprehensive text in learning to use the slide rule. From the basic instruction on how to hold the slide rule, through the simpler operations — such as multiplication, division, square and cube root, etc. — to more complex operations — such as sines and cosines, the reciprocal scale, etc., this book remains a leading work for both beginner and advanced student who needs, or is interested in, the slide rule.

Sheet Metal Drafting

By Melvin L. Beterley. Spiral binding, 314 pp., 7½ by 9¾ in., illus. McGraw-Hill Book Company, Inc., New York, N. Y.

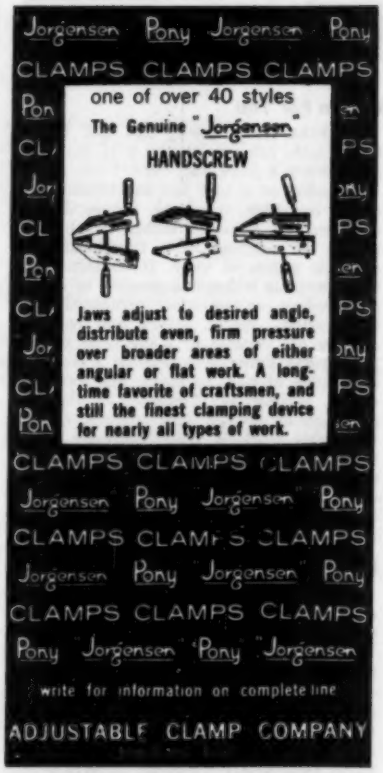
Designed for courses in technical institutes and vocational-industrial schools, this new textbook covers all phases of drawing: techniques, projection principles, and descriptive geometry — integrated and applied, whenever possible, to the sheet metal field. In addition to problems and solutions, the book stresses basic principles which can be applied to various situations as they arise. To help the student know how to handle more than certain developments and layouts, procedures have been described and the logic behind them been discussed. The first eight chapters concern the basic elements of drafting and serve as a general introduction to the sheet metal applications in the chapters on parallel-line, radial-line, and triangulation development.

Fractional Horsepower Motors

By Kennard C. Graham. Cloth, 256 pp., 5¾ by 8½ in., illus., $4.95. American Technical Society, Chicago, Ill.

Written "to fill the need of the serviceman for a concise explanation of motor theory and practical repair procedures based on sound electrical principles," this book explains basic principles of motor operation, essential motor components,

(Concluded on page 64)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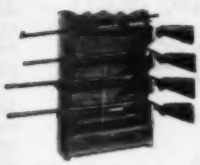

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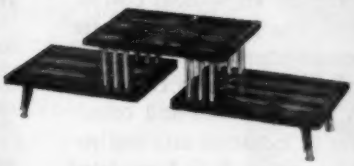

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NEW BOOKS

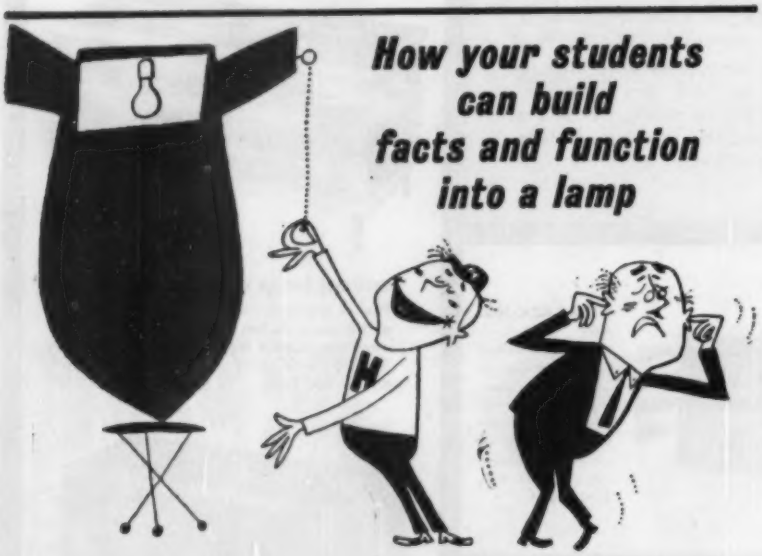
(Concluded from page 62)

armature winding, motor control, etc., with chapters on such various motors as the split-phase, the capacitor, the direct-current, universal, repulsion, and three-phase motors. Also has chapters on testing and maintenance, locating trouble, etc., as related to each of the above. The discussion of trouble shooting includes a series of concise, easily usable trouble charts in tabular form with various symptoms carefully arranged to isolate the fault in the quickest possible time by an effective, systematic procedure. It appears to be a valuable book for the vocational-industrial and technical student on the high school and junior college levels interested in fractional horsepower motors.

Automotive Fundamentals

By Ernest A. Venk and Walter E. Billiet. Cloth, 520 pp., 6¼ by 9¼ in., illus. American Technical Society, Chicago, Ill.

The second edition (and eighth printing) of a basic text in the essentials of automotive mechanics. While retaining the original purpose of the book to help the student achieve a thorough understanding of the operating principles of the modern automobile's units and equipment, reports from users of the first edition have led to clarified passages in this revision. Also the format has been altered to include the use of a function second color, intended "to make complex action more discernible." The parts of the book include those on the power plant, lubricating and tooling, fuel system, electrical systems, power train, and wheels, tires, and brakes.



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Printing Education in the United States

Compiled by John M. Fontana. Paper, 6 by 8¾ in., International Graphic Arts Education Association, Washington, 15, D. C.

An excellently written and presented short story of printing education in our schools. It traces the history of the subject, offers highlights of up-to-date courses of study on the I-A and V-I levels, and provides an idea of what should be offered in a printing education program on the technical institute and college course levels.

Educators Guide to Free Filmstrips

Compiled and edited by Mary Foley Horkheimer and John W. Diffor. 13 ed. Paper cover, 165 pp., 8¾ by 10¾ in., $6. Educators Progress Service, Randolph, Wis.

Includes a chapter of 36 listings of free filmstrips suitable for showing in areas of industrial arts and vocational-industrial education, most of which are offered by commercial concerns and their trade associations. There are some excellent sounding listings in the area of safety.

The Scientific Approach to Career Planning

By M. C. Cobb. Cloth, 142 pp., 5½ by 8¼ in., $3.95. Lantern Press, Inc., New York 10, N. Y.

An easily readable and appealing approach to searching the avenues of occupation in the fields of science, engineering, industry, commerce, trades, crafts, professions, arts, and services. For those who assist students in selecting a career and for the students themselves, here is a guide to how to begin to select a career "scientifically," how to follow through with studies for a career-job-specialty, where and how to make application, pitfalls to avoid, etc. It provides basic insights into a wide range of careers.

Factory Jobs — Employment Outlook for Workers in Jobs Requiring Little or No Experience or Specialized Training

Bulletin No. 1288, 26 pp., illus., 25 cents for single copy; a 25 per cent discount on orders of 100 or more copies. Release by the U. S. Department of Labor's Bureau of Labor Statistics in co-operation with the Veterans Administration.

Provides occupational information on an area of work representing one of the largest field; of employment — "operative" jobs in manufacturing industries. These semi-skilled jobs offer thousands of employment opportunities for persons with little or no specialized training or experience. Such occupations as assemblers, inspectors, machine tool operators, etc., are covered. Since 7½ million young persons are expected to leave high school before graduation and enter the labor force during the 1960's, this booklet is very appropriate for use by teachers, guidance counselors, etc., when working with this group.

Facts You Should Know

American Vocational Association pamphlet, paper covers, 8 pp., 4 by 9 in.

Intended primarily for policy-making and administrative personnel in education, this case for the "vocational and practical arts education" defines the subject and determines its contribution to our country's economic well being and its productive enterprises.

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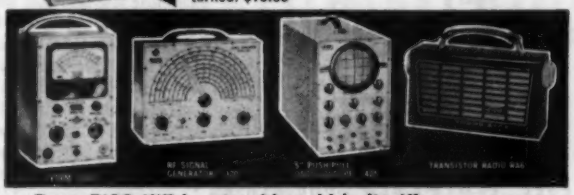

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TECHNICAL EDUCATION

(Concluded from page 14)

present 121. One technical institute, Wentworth Institute in Boston, now has 12 ECPD-accredited programs.

The curricula will undoubtedly change too. Automation will certainly encourage technical-institute programs in the existing fields of industrial technology (now four accredited programs); entirely new programs will probably develop in control technology and computer technology. Nuclear technology seems sure to be an offering within the next few years. Since the technical institute does not specialize as rigidly as a vocational school, it will continue to prepare for job clusters. A subject like radioactive fluid flow technology will probably be too highly specialized an offering.

Enrollments will, however, hardly rise as spectacularly as industrial demands would suggest. Many technical institutes are not full; at least one can double its enrollment with its present physical facilities. The GI-bills, which encouraged the technical-institute program, no longer underwrite enrollment; technical institutes are becoming predominantly "civilian" schools.

Southern Tech's experience has probably been typical. In 1948 it opened with 110 veterans out of a total enrollment of 116 — 95 per cent veteran. Its spring enrollment of 1961 included only 42 vets out of a total enrollment of 667 — a little over 6 per cent. Henninger found the median age of entering technical-institute students is 19 years, and this median has probably already dropped since Henninger's study.[3] Technical institutes are now competing for many of the same students sought by engineering colleges.

The Attractions

In attracting students the technical institute has three advantages. First, the total cost is lower — only about half that of a more conventional four-year college program. Second, investment in time is likewise halved for those who select a two-year technical institute instead of a four-year engineering college. Third, average starting salaries are good for technical-institute graduates. Starting salaries in 1960, for example, averaged slightly better than $400 per month for graduates of one of the better-known technical institutes.

Just as important, if less tangible, is the advantage of career satisfaction. Some high school graduates do not want an engineering program, are impatient with the four years required, and seek careers in applied rather than theoretical science. On the other hand, they are not interested in the skilled trades. For such students the technical institute is a custom-made answer.

For youngsters who see ahead in the technological age the technical institute will be more than a compromise between engineering and vocational education. It will be education tailored to length and need. □

[3] Henninger, *Ibid.*

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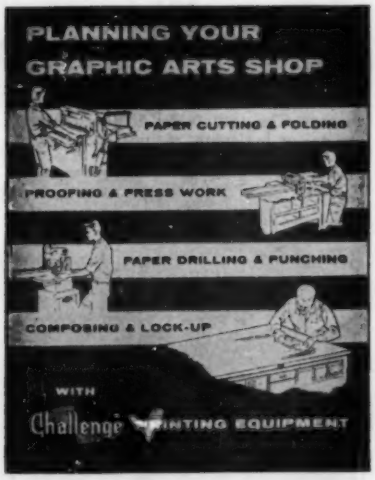

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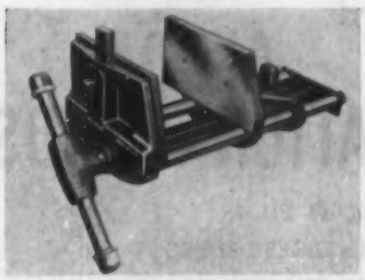
(For further details encircle index code 0801)

woodworkers' vise From The Columbian Vise & Mfg. Company, the 7-in. woodworkers' vise with 2½-in. left side clamping surfaces, offered under the trade

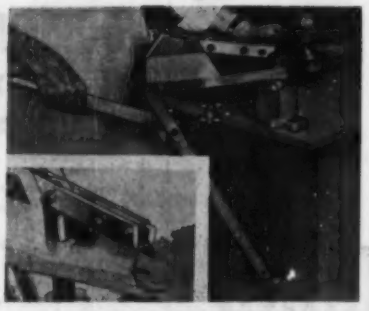


"Wide-Side" Woodworker's Vise

name "Wide-Side." New features include a graphite bronze thrust bearing which constantly lubricates the screw head without oil or grease. All vises are drilled and tapped for wood faces which can be installed or replaced without loosening from the bench. For complete "Wide-Side" data, please write to the manufacturer.

(For further details encircle index code 0802)

circular saw setter From Foley Manufacturing Company, a completely new circular saw setter that assures uniform set by means of a precision trip hammer. Designated Model 359, the new setter accommodates all circular saws from 5-in. to



Foley Model 359

38-in. diameter and from ½-in. to 2½-in. hole. Teeth may be rip, crosscut, or combination. Its reversible hammer has a narrow, tapered striking surface on one end for fine-tooth saws, and a wide, blunt surface for setting coarse teeth without denting or mashing on the other end. The Foley Model 359 weighs 54 lb., has a base width on bench 6 in., length on bench 23½ in., over-all length, 34 in. For more information please write to the manufacturer.

(For further details encircle index code 0803)

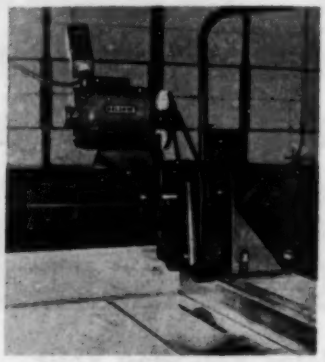
drill press From Rockwell Manufacturing Company's Power Tool Division, their new drill press — The Delta Unidrill — a two-foot-arm radial drill press, which fills the gap between expensive machine-tool type radial drill presses and light

Delta Unidrill

duty machines. Designed for use in vocational-agricultural, trade and industrial schools, as well as in general industry and pattern shops, commercial and job shops, and in the construction and building trades. The special qualities which make the Unidrill ideal for all of these fields are threefold: it is designed so that the tool is moved and positioned instead of the work, thus saving time and labor; its capacity is well beyond that available on an ordinary upright drill press; and it can be readily moved from one work area to another. For further details on its five-way flexibility, range of operations, and capacity, please write to the manufacturer.

(For further details encircle index code 0804)

power feeder From Belsaw Machinery Company, this new self-contained power feed unit for woodworking machinery; radial arm, bench or band saws, jointers, shapers, and sanders. It takes the hazards out of hand feeding by making the equipment completely self-power fed. It is quickly installed on present machinery and can be readily changed from one to another. The new feeder is adjustable for vertical or horizontal mounting, with vari-



Model 800 Power Feeder

able feed rates. It is powered by a ½ h.p. motor with a reversing switch. For more information on the Belsaw Model 800 Power Feeder please write to the manufacturer.

(For further details encircle index code 0805)

new line of ratchets From Crescent Tool Company, their newly introduced ratchets embodying increases in strength, serviceability, and simplicity. Invented by Crescent engineers, the new tools feature a small, oil-resistant neoprene rubber plug inside the device which eliminates the need for complicated and fragile springs — which are normally used to actuate and hold in position the pawls of a ratchet. The new Crescent Ratchet has a total of only seven parts, which obviates troublesome breakdowns and spring failures experienced by

Crescent Ratchets

ratchets containing 12 to 18 separate pieces. It is made in ¼-in., ⅜-in., ½-in., and ¾-in., square drive models. A special hollow handle of durable alloy steel was designed for the ¾-in. model to give it the added feature of lighter weight without any loss in strength. Extra safety is engineered into the design of the new line of ratchets, eliminating the danger of slippage which can result in painful hand bruises and other injuries to automotive mechanics and others working around motors and heavy duty equipment.

(For further details encircle index code 0806)

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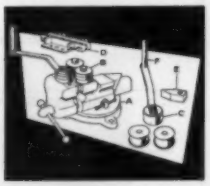

EXAMPLES OF SIMPLE PROJECTS FOR STUDENTS

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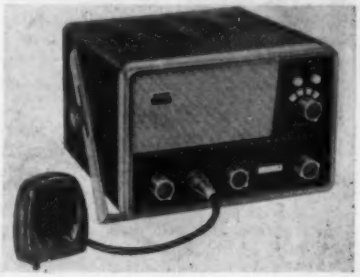
transceiver From Electronic Instrument Company, a new series of deluxe citizens band transceivers featuring multichannel operation, a choice of crystal or continuous receiving, a press-to-talk micro-



Model 772 Deluxe Citizens Band Transceiver

phone, a superheterodyne receiver with an RF stage and a 1750kc IF strip, and an adjustable squelch control and automatic "series-gate" noise limiter. All models — Nos. 770, 771, and 772 — have transformer-operated silicon diode doubler power supplies for 117 VAC 60-cycle operation. Models 771 and 772 have, additionally, vibrator power supplies for 6 VDC and 12 VDC battery operation respectively, and are equipped with both regular and heavy duty line cords having appropriately wired connection for 117 VAC and battery operation. For full information, please write to the manufacturer.

(For further details encircle index code 0807)

motorized film reader From Recordak Corporation, subsidiary of the Eastman Kodak Company, the Recordak Starlet, the low-cost motorized film reader developed for viewing microfilm images. It accepts 16mm. microfilm contained in Recordak film magazines, or with a simple adapter, can also accept microfilm spooled on conventional reels. The Starlet is avail-

Motorized Film Reader

able in two models to meet the electrical requirements of office or mobile installations, such as bookmobiles, service trucks, etc. Further information available.

(For further details encircle index code 0808)

electronic organ cutaway From Artisan Kit Organ Division, Dorsett Electronics, Inc., the cutaway model, developed for school use, exposes every basic component of the modern electronic organ. Designed for both the science and music classroom, the model is available in kit form with step-by-step instructions to en-

(Continued on next page)

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SHOP EQUIPMENT NEWS

(Continued from previous page)

Cutaway Model of Electronic Organ

able the students to assemble the unit in a few hours. Free brochure which describes creative classroom projects including the building of a full-size concert organ, and related accessories such as tuning forks and organ pipe demonstrators is available upon request.

(For further details encircle index code 0809)

adjustable typewriter platform

From Garrett Tubular Products, Inc., their newly patented adjustable typewriter platform to be used for adjustable typing

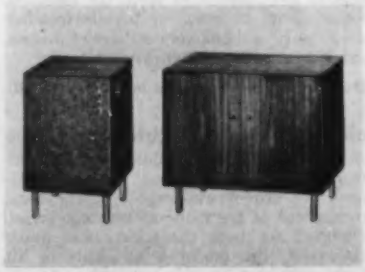
Adjustable Typewriter Platform

tables, adjustable teacher's demonstration stand, business machine stands, and other uses. Patent number is 2991030 and was issued July 4, 1961.

(For further details encircle index code 0810)

hi-fi equipment cabinets

From Allied Radio Corporation, the Knight Model KN-1700 equipment cabinet, specially designed for component high-fidelity systems. Available in a choice of mahogany, limed oak or walnut finishes, the unit is also offered in smoothly sanded unfinished form for do-it-yourself fans. Model KN-1700 features a lift-lid top for easy ac-



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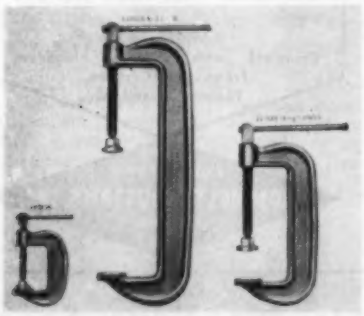
(For further details encircle index code 0811)

C-clamps From Proto Tool Company, three similar patterns with clamping capacities from 2 to 12 in., forged and heat-treated from selected steels. Short throat depth (from 1½ to 2⅞ in., on the largest size), and extra heavy threads give them maximum clamping pressure to meet fed-



General Service C-Clamps

eral specification GGG-C-406a. Each C-clamp is equipped with the patented Perma-Pad® which permits a firm seat on work through 60 deg. of arc, and will not come off even under pounding of a sledge hammer. Identified as Nos. 102GS through 112GS, the new Proto general service C-clamps have a light oil finish, an adjustable T-handle, and are guaranteed for parts, workmanship, and satisfactory performance.

(For further details encircle index code 0812)

wall chart of conversion factors From Precision Equipment Company, a reference table for shop men, engineers, and executives in wall chart form. Included are common conversions such as inches to centimeters or watts to h.p., as well as many conversions that are difficult to locate. Some such examples are atmospheres to Kgs/sq. cm, cm/sec to miles/hr, cu. ft. to liters, microns to meters, quintal to lb., etc. Please write to the company for a free copy of the Wall Chart of Conversion Factors.

(For further details encircle index code 0813)

Secretary checking the Precision Conversion Factor Sheet

tapewriter kit From Dymo Industries, Inc., the Dymo® Horizontal Vertical Tapewriter® Kit, featuring the new, money-saving vertical wheel attachment for the company's hand embossing tool. Permanent, easy-to-read, letter/number, horizontal or vertical labels can be made "on-the-spot" with the Special Dymo Kit. The finished labels with self-sticking back can be attached instantly, any legend, any

M-2 Tapewriter Kit

length, anywhere, indoors or out. The device has many uses and is particularly adaptable to use on shop machines and

(Continued on next page)

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SHOP EQUIPMENT NEWS

(Continued from previous page)

tools. Dymo vinyl tapes come in a wide variety of colors, providing a complete color coding system of labeling. Further information on special Model M-2 Tapewriter, and other models, is available upon request.

(For further details encircle index code 0814)

machine mounts From Hamilton Kent Manufacturing Company, Rexon Vibration Mounts, consisting of X-shaped rubber or neoprene elements enclosed in steel cases, for quiet operation and flexibility of metalworking shop equipment. To

Rubber-in-Shear Machine Mounts

prevent transmission of vibration to the floor, and to suppress sound, vibration mounts are placed under machines having rotary or impact motions, such as lathes, and horizontal and vertical mills. Weight of the machine is supported "in shear" by the elements, and not by compression, and the mounts do not require bolting to the

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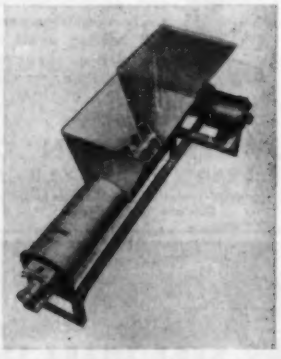
floor. Effective in lowering the noise level when a number of machines are in operation. More information on Rexon Vibration Mounts available by writing to the manufacturer.

(For further details encircle index code 0815)

first aid station From General Scientific Equipment Company, their new space-saving first aid station for school-shop use. This cabinet is especially useful where fast, immediate first aid treatment must be given, as with caustic burns of the eyes and skin, to prevent serious organic injury. Finished in durable, white, baked-on enamel, dimensions are 66 in. high, 24 in. wide, and 12 in. deep, 11 cubic feet, weight approximately 52 lb. Cabinet may be purchased completely stocked with first aid supplies, at additional cost.

(For further details encircle index code 0816)

pug mill From the Walker Jamar Company, manufacturer of pottery equipment and custom fabricator of metals, the new compact and efficient Walker Pug Mill. Designed for mixing clay in ceramics classrooms and studios, the new mill mixes more than 300 lb. of clay per hour to throwing or modeling consistency. Dry



The Walker Pug Mill

powdered clay, moistened clay chunks, and slip, slurry, or water are dumped into the hopper. The mixed clay is expelled from the discharge end of the machine, ready to use. The mill is designed to eliminate manual mixing and save classroom time. It is 5 ft. 10 in. long, 2 ft. 3 in. maximum width, and 2 ft. 7 in. high. Mixing is provided by 32 blades and two screw flight sections which rotate on a forty-inch shaft and interact with 9 fixed baffles. Further information available.

(For further details encircle index code 0817)

contact-type veneer glue From Albert Constantine and Son, Inc., their new development of a nonstaining, quick contact adhesive for attaching thin veneers to either old or new surfaces is a major advance for amateur woodworkers. With no tools other than a sharp knife for trimming the sheets of veneer, and a roller (or rolling pin) for pressing, anyone can now use veneers. The new veneer glue is spread

(Continued on next page)

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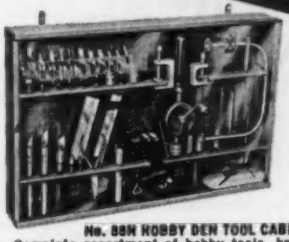

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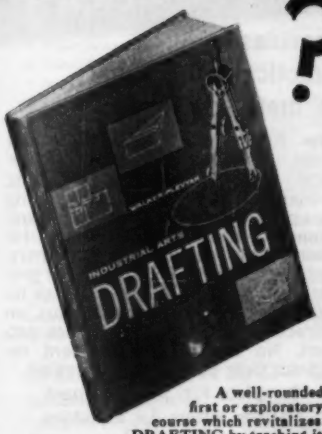

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SHOP EQUIPMENT NEWS

(Continued from previous page)

on both surfaces to be joined, is allowed 20 minutes for drying, and the veneer sheets are then rolled in place. This glue is supplied in liquid form, ready to use. It permanently bonds wood to wood, wood to metal, and wood to composition board, all without clamps. It is available in one pint and one quart cans, both with applicator brushes. Write for details.

(For further details encircle index code 0818)

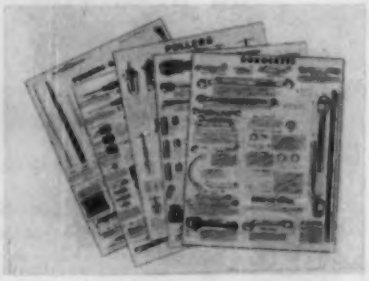
plastic gallon bottle From The Borden Chemical Company, an addition to their packaged line of Elmer's Glue-All, the new "Easi-Grip" container replaces both metal and glass for gallon sizes of the liquid plastic resin glue—an all-purpose adhesive produced by the Consumer Products Department of Borden's. Advantages

Gallon-Size Plastic Container

of the new plastic gallon include easier handling, greatly reduced breakage, and lighter weight. For further information and free copies of catalog page CPD-202, write to the manufacturer.

(For further details encircle index code 0819)

instruction charts From Snap-on Tools Corporation, a set of five wall charts available to school shop instructors of mechanical trade subjects. They measure 22 inches wide by 28 inches deep and are printed on heavy weight stock. Each chart



Instruction Charts

covers one particular series of tools and shows the various types that are in common use. Textual matter is held to the minimum required to give the student a basic understanding of the various tools illustrated. The five types of tools covered are punches and chisels, screw drivers, pullers, box wrenches, and socket wrenches. A set of these charts may be obtained free if requested on school letterhead.

(For further details encircle index code 0820)

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(For further details encircle index code 0821)

DESCRIPTIVE MATERIAL

From the R. K. LeBlond Machine Tool Company, Bulletin R-215, which presents their new 12-, 15-, 17-, and 19-in. Regal engine lathes. Includes an interesting description of the forces of turning every lathe must withstand to maintain its accuracy, and how Regal design features negate these forces. Specifications and operating descriptions of the Regal 17- and 19-in. plain and sliding bed gap lathes are also included. Free copy of bulletin available.

(For further details encircle index code 0822)

From Wilton Tool Mfg. Company, Inc., a colorful catalog on their 7-in. offset woodworking vise. Catalog No. 732 demonstrates the vise's advantages, and in addition, gives descriptions and dimensions for the Wilton machinists' bench vise, both with and without swivel base; the professional woodworkers' vise; and the junior grade woodworkers' vise. Write to the manufacturer for a free copy of catalog.

(For further details encircle index code 0823)

From The L. S. Starrett Company, Catalog No. 27—third edition—presents in 480 pages a complete display of the Starrett line of more than 3500 items including all new tools introduced since the previous edition.

Completely reset in larger type for easier reading, the new edition has been arranged for quick reference with sections on mechanics' hand measuring tools and precision instruments, dial indicators, dial gauges and instruments, special tools, hack saws, hole saws, band saws, band knives and precision ground flat stock.

The new catalog also contains twenty pages of useful reference tables and has alphabetical and numerical indexes to all items as well as an index to all new tools added since the previous edition. Copies of the new catalog are available upon request.

(For further details encircle index code 0824)

From Stacor Equipment Company, an illustrated brochure providing complete specifications on new Stacor-matic "Coordinate Group" modular drafting furniture. These include the "L" series—drafting table and reference desk ensemble; the "D" series—single unit drafting desk; and the "D-A" series—drafting desk with integral drawer unit. The special advantages forthcoming from Stacor's exclusive Lino-Draft drawing surfaces, "floating board" action and "toe-touch" control are also described in detail. Copies of the bulletin available on request from the manufacturer.

(For further details encircle index code 0825)

(Continued on next page)

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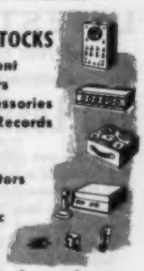

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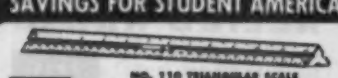

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descriptive . . .

(Continued from previous page)

From Rockwell Manufacturing Company's Walker-Turner Division, a newly revised 48-page catalog, describing their complete line of light-heavyweight machine tools and accessories. Included in the catalog are complete specifications and listings of accessories for all tools. Photos and drawings supplement the text. Please refer to Catalog WT-50 Rev. 4, when requesting a copy.
(For further details encircle index code 0826)

From Stanley Tools, instructional material available for school shop instructors, offered at the cost of printing and postage only. In the case of films, only the cost of reprints and postage is asked. A special offer on filmstrips and projector is listed. The complete film library offers 53 lessons or strips with 820 illustrations. The charts, plans, and other teaching aids are valuable and interesting for school shop use. Further information available.
(For further details encircle index code 0827)

From H. W. Knight and Son, Inc., their new 24-page catalog illustrates and describes Knight's recently expanded line of metal letters and figures. Includes trademarks, and monograms, formerly available from Canton Products, which was acquired by H. W. Knight in 1960. Copy free upon request.
(For further details encircle index code 0828)

From Craftools, Inc., the 1961 16-page catalog on art metalcraft containing a comprehensive range of items including: jewelry making equipment, tools and centrifugal casting; buffing wheels and compounds; polishing accessories and wheels. All items are fully illustrated. Catalog free upon request on school letterhead.
(For further details encircle index code 0829)

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Code No.		Page No.
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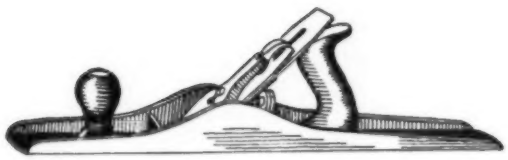

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